Theories and models of emotion: A swamp (?)

Klaus R. Scherer
University of Geneva
An actuarial study of Swiss emotions

Representative sample of the Swiss population, N = 1003. Question: Describe the strongest emotion you had **yesterday**. How would you call it?

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Percentage</th>
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<tbody>
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<td>Happiness</td>
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<tr>
<td>Anger</td>
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<td>Anxiety</td>
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<td>Uncodable</td>
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<td>Irritation</td>
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<td>Fear</td>
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<td>Stupefaction</td>
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<td>Surprise</td>
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<td>Guilt</td>
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<td>Relaxation / Serenity</td>
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<td>Relief</td>
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<td>Love</td>
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<td>Amusement</td>
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<td>Gratitude</td>
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<td>Hate</td>
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<td>Interest</td>
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<td>Disgust</td>
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<td>Longing</td>
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<td>Being touched</td>
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<td>Admiration / Awe</td>
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Lost luggage study: A prevalence of emotion blends

Ordered Display of Emotion Blends

Participants

Intensity

Anger
Stress
Sadness
Indifference
Good Humour
Posing the problem: Three types of computational models

EMOTION

Goal state
Event

Elicitation & Differentiation model

Decoding model

HormoRob
FearNot!

How can the emotion be predicted and how should it be displayed?

Encoding model

EMOTION

Encoding Agent

Decoding agent

Physiol. Reactions
Motor expression

Physiol. Reactions
Motor expression

ERMIS
MAUI

GRETA
NECA

What are the best indicators or cues?

Appraisal criteria
Integration rules
Sequential process

Physiol. Reactions
Motor expression

What are the best indicators or cues?
Current theories of emotion differ in their emphasis on components and phases.

Phases of the emotion process

<table>
<thead>
<tr>
<th>Components</th>
<th>PHASES</th>
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<tr>
<td>Cognitive</td>
<td>Low-level evaluation</td>
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<tr>
<td>Physiological</td>
<td>High-level evaluation</td>
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<tr>
<td>Expressive</td>
<td>Goal/need priority setting</td>
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<tr>
<td>Motivational</td>
<td>Examining action alternatives</td>
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<tr>
<td>Feeling</td>
<td>Behavior preparation</td>
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<td>Behavior execution</td>
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<td></td>
<td>Communication - Sharing with others</td>
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</table>

- Adaptational models
- Appraisal models
- Motivational models
- Circuit & Discrete Emotion models
- Meaning & Construct models
- Dimensional models
Component process model - Response patterning

Event

Components

Time

System interaction and regulation

CNS Information Processing (Appraisal)
- Novelty
- Pleasantness
- Goal Significance
- Coping Potential
- Norm Compatibility

Support (ANS physiology)

Motivation (Action tendencies)

Execution (Motor expression)

Monitoring (Feeling state)
<table>
<thead>
<tr>
<th></th>
<th>Conducive</th>
<th>Obstructive</th>
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</thead>
<tbody>
<tr>
<td><strong>NES</strong></td>
<td>EEG synchronisation</td>
<td>corticosteroid and catecholamine, particularly adrenaline secretion</td>
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<tr>
<td><strong>ANS</strong></td>
<td>decrease in respiration rate, slight HR decrease, vasodilatation in sexual organs, increase in glandular secretion, bronchial constriction, increase in gastro-intestinal motility, relaxation of sphincters,</td>
<td>deeper and faster respiration, increase in HR and heart stroke volume, vasoconstriction in skin, gastro-intestinal tract, and sexual organs, vasodilatation in heart and striated musculature, increase of glucose and free fatty acids in blood, decreased gastro-intestinal motility, sphincter contraction, bronchial dilatation, contraction of m. arrectores pilorum, decrease of glandular secretion, increase in SC level, pupillary dilatation</td>
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<tr>
<td><strong>SNS</strong></td>
<td>decrease in general muscle tone</td>
<td>SNS: increased muscular tonus</td>
</tr>
<tr>
<td><strong>FACE</strong></td>
<td>relaxation of facial muscle tone</td>
<td>AUs 4 (brow lowerer, frown), 7 (lids tighten), 23 (lips tighten), 17 (chin raising); gaze directed</td>
</tr>
<tr>
<td><strong>VOICE</strong></td>
<td>overall relaxation of vocal apparatus (F0 at lower end of range, low-to-moderate amplitude, balanced resonance with slight decrease in high-frequency energy - &quot;relaxed voice&quot;)</td>
<td>overall tensing of vocal apparatus (F0 and amplitude increase, jitter and shimmer, increase in high frequency energy, narrow F1 bandwidth, pronounced formant frequency differences - &quot;tense voice&quot;)</td>
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</tbody>
</table>
Multimodal response integration: Tom Johnstone's thesis

SCL level

Glottal open time (EGG)

F0 floor
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<tr>
<th>Action Units</th>
<th>ENJ/ HAP</th>
<th>ELA/ JOY</th>
<th>DIS/ DISG</th>
<th>SAD/ DEP</th>
<th>DESP/ AIR</th>
<th>ANX/ WOR</th>
<th>FEAR/</th>
<th>IRRI/ COA</th>
<th>RAG/ EHOA</th>
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<td>Inner brow raisers</td>
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<td>Lids droops</td>
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<td>Eyes close</td>
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Component process model - Monitoring and regulation via multimodal integration

SNS

ANS

Motivation

Appraisal

Regulation

Feeling

Quality

Intensity

Duration

patterning and weight of criteria

patterning and amplitude

patterning and amplitude

urgency
Component process model - Internal representation and feeling

Unconscious reflection and regulation

Conscious representation and regulation

Physiological symptoms

Motor expression

Action tendencies

Cognitive appraisal

Unconscious reflection and regulation

Zone of valid self-report measurement

Verbalization and communication of emotional experience
Solutions depend on the level of representation and verbal encoding of emotion

- Appraisal criteria checking
  - Criteria-specific outcomes
- Componential patterning
  - Outcome-specific responses
- Integration to unique feeling
  - Integration and synchronisation
- Qualia emotions
  - Specific to individuals
    - Semantic feature rules
- Labelled emotions
  - Specific to language/culture
    - Semantic field rules
- Modal (basic) emotions
  - Universal
    - Semantic dimension rules
- Affective dimensions
  - Universal

Preferences
Attitudes
Stances
Moods

These are NOT Emotions – but your ECAs might like them better
Direct links to dimension mapping

- Appraisal criteria checking
  - Criteria-specific outcomes

- Componential patterning
  - Outcome-specific responses

- Integration to unique feeling
  - Integration and synchronisation

- Qualia emotions
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- Modal (basic) emotions
  - Universal
    - Semantic dimension rules

- Affective dimensions
  - Universal
Scherer, Abeles, & Fischer, 1975, p. 138; see also Scherer, 1984b, p. 38):

"Specifically, the positive/negative evaluation dimension was seen to result from the intrinsic or inherent pleasantness or unpleasantness of a stimulus, the activity dimension from a mismatch between goal-/plan-related expectations and the actual state (requiring action), and the potency dimension from the organisms estimate of how well it would be able to cope with the particular stimulus event and its consequences".
Tetrahedral model of the emotional space
Gehm & Scherer, 1988
### Predicting dimension ratings from appraisal based on IAPS pictures

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<th>Affect scale</th>
<th>Predictor(s)</th>
<th>Standardized β</th>
<th>t</th>
<th>p</th>
<th>Cumulated Adjusted $R^2$</th>
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<tr>
<td>Valence</td>
<td>Unpleasant/pleasant</td>
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<td>48.04</td>
<td>&lt; .001</td>
<td>.976</td>
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<td>Arousal</td>
<td>Chance/Human agency</td>
<td>.505</td>
<td>5.69</td>
<td>&lt; .001</td>
<td>.507</td>
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<td></td>
<td>Low/high coping ability</td>
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<td>-4.938</td>
<td>&lt; .001</td>
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AUs in actor portrayals of major emotions
Munich actor study – 14 emotions, 16 tokens each

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Facial AUs

EMOSYSNR

au1_2
au4_11
au6_12
au25_26

Mean

Hot anger, Cold anger, Panic fear, Anxiety, Despair, Sadness, Elated joy, Happiness, Interest, Boredom, Shame, Pride, Disgust, Contempt
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Acoustic voice parameters

EMOSYSNR

Contempt Disgust Pride Shame Boredom Interest Happiness Elated joy Sadness Despair Anxiety Panic fear

Mean

-1.5

Hot anger Cold anger Panic fear Anxiety Despair Sadness Elated joy Happiness Interest Boredom Shame Pride Disgust Contempt

hif0enrr hi1k hihamm hi5k hidur
Geneva
Emotion Research Group

Gestures

EMOSYSNR

- Contempt
- Disgust
- Pride
- Boredom
- Interest
- Happiness
- Elated joy
- Sadness
- Despair
- Anxiety
- Cold anger
- Hot anger
- Panic fear

Mean
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Multimodal
What are the controls? And for how long?

System architecture
Individual dispositions
Current motivation
Emotion
Interaction goal/immediate plan
Cultural & contextual rules

Voice
Face
Gestures
Posture
Multimodal
What are the controls? And for how long?

System architecture | Individual dispositions | Current motivation | Emotion | Interaction goal/ immediate plan | Cultural & contextual rules

Voice | Face | Gestures | Posture
Multimodal
What are the controls? And for how long?

System architecture  Individual dispositions  Current motivation  Emotion  Interaction goal/ immediate plan  Cultural & contextual rules

Voice  Face  Gestures  Posture
What are the controls? And for how long?

System architecture, Individual dispositions, Current motivation, Interaction goal/ immediate plan, Cultural & contextual rules

Emotion

Voice, Face, Gestures, Posture
Multimodal

What are the controls? And for how long?

- System architecture
- Individual dispositions
- Current motivation
- Emotion
- Interaction goal/ immediate plan
- Cultural & contextual rules

- Voice
- Face
- Gestures
- Posture
Multimodal
What are the controls? And for how long?

- System architecture
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- Voice
- Face
- Gestures
- Posture
Multimodal
What are the controls? And for how long?

System architecture → Individual dispositions → Current motivation → Emotion → Interaction goal/immediate plan → Cultural & contextual rules

Speech production
Segmental → Semantic → Speech acts → Dialog

Voice → Face → Gestures → Posture
Studying process: Pascal Edwards’ thesis

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Anxiété

Phase d’anticipation de la nouvelle

Joie

Phase de réaction à cette nouvelle

Temps

max(I)

Instant $t_1$: 5 minutes avant l’annonce

Instant $t_2$: la prise de connaissance de la réussite
Most important determinant of intensity: Pascal Edwards’ thesis

- **Fear**: Importance of goal obstructiveness, degree of unexpectedness
- **Anger/Rage**: Feeling socially superior, low self-evaluation
- **Joy**: Importance of long-term consequences
- **Sadness**: Difficulty of adjustment to loss
- **Happiness**: Extent of goal conduciveness
Norman Anderson claims that the regression model is inadequate to describe information integration in emotion-antecedent appraisal and pleads for the detailed study of integration rules.

Modeling and measuring the integration of appraisal results -- based on Anderson (1989)

Parallel lines = additive function
Modeling and measuring the integration of appraisal results - based on Anderson (1989)

Extent of Goal Obstruction

Intensity of Anger

intentional
accidental
not responsible

Agency

Fan-shaped lines = multiplicative function
Catastrophe Theory
An Example of Hysteresis

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Frustration

Anger

Hysteresis

Frustration
Modeling and measuring the integration of appraisal results -- a nonlinear approach

Extent of Goal Obstruction

Intensity of Anger

intentional

accidental

not responsible
Catastrophy Model of Fear/Anger Conflict
(Zeeman, 1976)