Positive Emotions

Emotional Change
How do emotions foster close relationships?
Caregiving is Hard-Wired in Highly Social Species

consolation

Plotnik & deWaal, 2014

deWaal & Suchak, 2010

helping

Douglas et al., 2006

deWaal, 2007
Prosocial Behaviors Occur Spontaneously

Horner et al., 2011
Plotnik et al., 2011
Altruistic Helping Behavior

Plotnik et al., 2011
What are emotions?

Short-lived phenomena

- **Psychological**
  - Alter attention, shift certain behaviors upward in response hierarchies, activate memory networks

- **Physiological**
  - Rapidly organize the responses of disparate biological systems (e.g., facial expression, somatic muscular tonus, voice, ANS)

Levenson, 1994
emotional brain networks

interoception

emotion regulation

emotional reactivity

appraisal

afferent representation

visceromotor reactivity
<table>
<thead>
<tr>
<th>Emotions Shape Our Responses in Diverse Contexts</th>
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<td><strong>Threat</strong></td>
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<td><strong>Loss</strong></td>
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<td><strong>Contamination</strong></td>
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<td><strong>Unfairness</strong></td>
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<td><strong>Play</strong></td>
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<td><strong>Kinship Bond</strong></td>
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<td><strong>Faux Pas</strong></td>
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<td><strong>Achievement</strong></td>
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<td><strong>Fear</strong></td>
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<td><strong>Sadness</strong></td>
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<td><strong>Disgust</strong></td>
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<td><strong>Nurturant Love</strong></td>
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<td><strong>Embarrassment</strong></td>
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<td><strong>Pride</strong></td>
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*NEGATIVE* and *POSITIVE* indicate the nature of the responses. *SELF-CONSCIOUS* responses are associated with personal experiences or self-reflection.
Positive Emotions Serve Important Social Functions

• Family of positive emotions
  – Compassion, nurturant love, awe, enthusiasm, amusement, calm, gratitude

• Facilitate:
  – Approach behavior
  – New relationships
  – Creativity, generation, and expansive thinking

Fredrickson, 2004; Griskevicius et al., 2010
Positive Emotions: Restore and Buffer

• Positive emotions:
  – “Undo” negative emotional states
  – Counter effects of chronic stress
  – Foster resilience
  – Are associated with lower physiological arousal

Levenson, 1988; Moskowitz, 2003
The Autonomic Nervous System Connects Brain to Body

Parasympathetic
- Tend and befriend
- Physiological decrease

Sympathetic
- Fight or flight
- Physiological increase

Parasympathetic Division
- Constricts pupil
- Stimulates tear glands
- Strong stimulation of salivary flow
- Inhibits heart, dilates arterioles
- Constricts bronchi
- Stimulates stomach motility and secretion, stimulates pancreas
- Stimulates intestinal motility
- Constricts bladder

Sympathetic Division
- Dilates pupil
- No effect on tear glands
- Weak stimulation of salivary flow
- Accelerates heart, constricts arterioles
- Dilates bronchi
- Inhibits stomach motility and secretion, inhibits pancreas and adrenals
- Inhibits intestinal motility
- Stimulates erection
- Stimulates ejaculation
The Parasympathetic Nervous System Lowers Autonomic Arousal

- Inspiration increases heart rate
-Expiration decreases heart rate
Parasympathetic Activity is Advantageous

- Slower breathing:
  - Decreases heart rate
  - Increases heart rate variability

- Higher heart rate variability is associated with:
  - Positive emotion
  - Prosocial behavior
Parasympathetic Tone Promotes Positive Emotion

• Lower negative emotion
• Greater positive experience to neutral situations
• Higher positive mood
• Greater optimism and agreeableness
• Sweet spot for parasympathetic functioning?

Fabes & Eisenberg, 1997; Oveis et al., 2009; Kogan et al., 2014
Compassion Motivates Helping

Compassion
- Other-related emotion
- Positive feelings: e.g., love
- Good health
- Approach & prosocial motivation

Empathic distress
- Self-related emotion
- Negative feelings: e.g., stress
- Poor health, burnout
- Withdrawal & non-social behavior

Singer & Klimecki, 2014
Sharing Positive Emotions is Rewarding in the Brain

- Compassion activates reward networks
- Sharing others’ positive emotions also activates reward networks

Klimecki et al., 2013; Morelli et al., 2014
Gratitude Helps to Sustain Close Relationships

• Important social functions
• Find-remind-and-bind theory
• Gratitude solidifies relationships with supportive, loyal partners

Algoe, 2012
Awe is Good for Your Mind and Body

- Feeling of wonder when in the presence of something vast, large, or hard to grasp
- Associated with:
  - Cognitive restructuring
  - Decreased self-focused attention
  - Lower inflammatory levels

Keltner & Haidt, 1999; Shiota et al., 2007; Stellar et al., 2015
Positive Emotion and the Upward Spiral

Kok & Fredrickson, 2010
How do changes in patients’ emotions alter relationships?
Brain Diseases Change Relationships by Altering Emotion

Behavioral Variant Frontotemporal Dementia (bvFTD)

Alzheimer’s Disease (AD)
Brain Lesions From Various Causes Have Similar Impact on Behavior

- Individual patients have taught us an enormous amount about brain-behavior relationships
- Diseases/tumors/injuries that target these regions will have similar impact on thinking and behavior
bvFTD
• Socioemotional symptoms primary
• Social and emotional \textit{impairment}
• Anterior: medial frontal and insula

AD
• Cognitive symptoms primary
• Social and emotional \textit{preservation}
• Posterior: parietal and medial temporal
bvFTD Example:
Loss of Empathy
AD Example:
Preservation of Social Decorum
Loss of Emotion May Alter Behavior

- Appraisal
- Reactivity
- Emotional Response

Antecedent

- Embarrassment deficits in bvFTD

Emotional Empathy

- Emotional empathy deficits in bvFTD

Reappraisal

- Autonomic Reactivity
- Facial Expression

Suppression

- Amplification
- Substitution

Emotional Regulation

- I feel sad.
- I feel embarrassed.
- I feel happy.

Loss of emotion may alter behavior, affecting social faux pas, reactivity, and others' emotions. Emotional empathy deficits in bvFTD can lead to embarrassment deficits. Autonomic reactivity, reappraisal, and emotional regulation play crucial roles in managing emotional responses.
Laboratory Measurement of Emotion

- **Physiological Reactivity**
  - Heart rate, respiration, skin conductance, finger temperature, ear pulse, finger pulse, somatic activity, blood pressure, heart rate variability, cardiac impedance, facial EMG, pupil diameter

- **Facial Behavior**

- **Self-Report**

  Did you feel sad while watching the film?
  
  1: No  
  2: A little  
  3:  
  4:  
  5: A lot
Self-Conscious Emotions Serve Interpersonal Functions

• Social emotions
  – Guilt, pride, shame, and embarrassment
  – Social evaluation

• Embarrassment
  – Emerges after violation of a social convention
  – Characteristic facial display and physiological activation
  – Promotes reparation of disrupted social bonds
Self-Representations: Uniquely Human?

- Self-representations are progressively more complex across phylogeny (Povinelli & Cant, 1995)
- Self-recognition is seen in highly social species
  - Human infants (Papousek, 1974)
  - Great apes (Gallup, 1970)
  - Elephants (Plotnik, 2006)
  - Dolphins (Reiss, 2001)
Neural Correlates of Self-Processing

- Medial networks
- Medial prefrontal cortex

Northoff et al., 2006
Laboratory Assessment: Karaoke Task

Facial Behavior
- Anger, sadness, disgust, fear, surprise, confusion, contempt, happiness, embarrassment
- Intensity: 0-3

Autonomic Reactivity
- Heart rate
- Respiration
- Skin conductance level
- Finger pulse
- Temperature

Sturm et al., 2008
Diminished Self-Conscious Emotional Reactivity in bvFTD

- bvFTD < controls in embarrassment behavior and ANS reactivity
- Smaller volume in right pregenual anterior cingulate cortex is associated with lower ANS and behavioral response

Mean Total Emotional Behavior

* = $p < .05$

Sturm et al., 2008; Sturm et al., 2012
Embarrassment Examples

Healthy Control  bvFTD
What is empathy?

- **Emotional Empathy**
  - Facial Mimicry
  - Autonomic Reactivity

- **Cognitive Empathy**
  - Emotion Recognition
  - Perspective-Taking

- **Prosocial Behavior**
  - Affiliation
  - Compassion

- **Perception**
  - Detection of Socioemotional Stimuli

photograph by Dorthea Lange
Emotional Empathy is Affect-Sharing

• Mirroring of others’ emotions
  – Mimicry
  – Autonomic simulation
  – Rapidly
  – Without conscious awareness

• Evolutionarily conserved
  – Present in other species
  – Present in human infants

• Depends on emotion generation brain systems
  – Insula, ACC → central amygdala, hypothalamus → PAG

Photo credit: Mancini, 2013
Socioemotional Preservation in AD

- Clinical observations
  - Intact (enhanced?) social behavior in AD

- Emotional symptoms are common
  - In MCI (35-85%) and AD (75%)

- Increased salience network connectivity in AD (Zhou, 2010)
  - Relates to agitation, irritability, aberrant motor behavior (Balthazar, 2013)

- Increased emotional contagion in AD?
A. Emotional Contagion

- Controls: Men and Women have similar levels.
- MCI: Men and Women show a significant increase compared to controls.
- AD: Men and Women show a significant increase compared to controls.

B. Depressive Symptoms

- Controls: Men have lower levels than Women.
- MCI: Men and Women show a significant increase compared to Controls.
- AD: Men and Women show a significant increase compared to Controls.

* = p < 0.01 and ** = p < 0.001
Right Temporal Lobe Degeneration is Associated with Higher Emotional Contagion

blue = $p < .001$, uncorrected, and hot = $p_{FWE} < .05$
Laboratory Assessment of Emotional Empathy

**Task**
- 4 film clips in which the character displayed:
  - enthusiasm
  - calm
  - affection
  - amusement

**Facial Behavior**
- Tuning of facial expression to that of character
- Total happiness/total emotion displayed
Facial Mimicry in Diminished in bvFTD

covariates: sex, age, and education

* denotes Bonferroni-adjusted, p< .05
Resting Parasympathetic Tone is Low in bvFTD

* = p < .05

covariates: sex, age, education

Sturm et al., in prep.
How do patients’ emotional changes impact caregivers’ health?
Potential Costs to Caregiving

- Increased burden
- Increased depression and anxiety
- Lower self-rated physical health, greater health care utilization, greater decline in cellular immune functioning
- Lower self-rated well-being
- There are large individual differences in these outcomes

*e.g., Schulz et al., 1990, 1995; Dura et al., 1991; Kiecolt-Glaser et al., 1991*
What are the sources of individual differences in caregiver outcomes

Study led by Robert Levenson, PhD and Jennifer Merrilees, RN, PhD
Disease-Specific Impacts on Caregivers’ Language and Marital Satisfaction

- Couples in which one person had bvFTD or AD had a conversation about an area of conflict.
- Caregivers of patients with bvFTD used more negative words than caregivers of patients with AD.
- Couples with FTD had lower marital satisfaction than couples with AD.

Ascher et al., 2009
Changes in Connectedness Can Accompany Disease

- Inclusion of Other in Self Scale
- Decreases in inclusion predict:
  - decreases in life satisfaction and
  - Increases in caregiver burden

Connelly et al., in prep.
Positive Emotions

Emotional Change
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• **Our patients, controls, and their families**
TAKE A DEEP BREATH
THEN CONTINUE