Cognition and Emotion
November 12-19, 2009

What is emotion?
• Communication mechanisms that maintain social order/structure
• Behavior learned through operant or classical conditioning or nonassociative learning, not involving deliberate cognitive mediation
• Appraisal of biopsychosocial situation
• Complex physiological response
• Integrated, three-response system construct
  – Motor behavior
  – Physiological activity/arousal
  – Cognitive appraisal

Areas of Inquiry
• Effect of emotion on performance (e.g., memory, perception, attention)
• Information processing characteristics of emotional disorders (e.g., anxiety, depression)
• Emotion and social learning
• Cognitive neuroscience of emotions
  – Cognitive structure of emotion
  – Neuropsychological studies
  – Cognitive aspects of emotion (e.g., appraisal)

Introduction & History
• James-Lange theory
• Cannon-Bard theory
• Schacter & Singer studies (2-factor theory)
• Facial feedback hypothesis
• Neurobiological contributions (Davis, LeDoux)
• Neuropsychological perspectives
  – Somatic markers
  – Emotional signal processing
• Information-processing theories

James-Lange
• "My theory ... is that the bodily changes follow directly the perception of the exciting fact, and that our feeling of the same changes as they occur is the emotion. Common sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, and angry and strike. The hypothesis here to be defended says that this order of sequence is incorrect ... and that the more rational statement is that we feel sorry because we cry, angry because we strike, afraid because we tremble ... Without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colorless, destitute of emotional warmth. We might then see the bear, and judge it best to run, receive the insult and deem it right to strike, but we should not actually feel afraid or angry"

Cannon-Bard
• We feel emotions first, and then feel physiological changes, such as muscular tension, sweating, etc.
• In neurobiological terms, the thalamus receives a signal and relays this both to the amygdala (a limbic structure) and the cortex. The body then gets signals via the autonomic nervous system to tense muscles, etc.
Two-Factor Theory (e.g., Schacter & Singer)
- When trying to understand what kind of person we are, we first watch what we do and feel and then deduce our nature from this. This means that the first step is to experience physiological arousal. We then try to find a label to explain our feelings, usually by looking at what we are doing and what else is happening at the time of the arousal. Thus we don’t just feel angry, happy or whatever: we experience feelings and then decide what they mean.

Cognitive Appraisal Theory (e.g., Lazarus)
- In the absence of physiological arousal, we decide what to feel after interpreting or explaining what has just happened. Two things are important in this: whether we interpret the event as good or bad for us, and what we believe is the cause of the event.
- In primary appraisal, we consider how the situation affects our personal well-being. In secondary appraisal we consider how we might cope with the situation.

Somatic Marker Theory
- Bodily states play a role in decision-making and reasoning
- “Somatic markers” link memories of experience (cortex) with feelings (limbic)
- Attempts to account for ‘automatic’ or ‘unconscious’ biases

Fear Conditioning

Preattentive Perception of Threat: Öhman
- Distinction between automatic v. controlled information processing
- Draws on animal work (LeDoux) - direct thalamic-amygdala connection
- Threat: biological and ‘derived’
- Data:
  - responses to masked stimuli
  - slowed RT to threat words in shadowing

Emotion and Memory

Flashbulb Memories
- Distinct, vivid, recollections of shocking events, and associated personal activities
- Long-lasting? Accurate? Special?
  - Brown & Kulick (1977): special encoding mechanism (NOW PRINT!)
  - Niesser & Harsh (1992) Challenger study
  - Although FM appear to be different subjectively (they provide an intersection between personal history and “History”), they are not necessarily more accurate
  - Confidence is not equivalent to accuracy

Flashbulb Memories of September 11, 2001
Valence and Memory

- Negative events remembered in more vivid detail than positive events
- Positive events more associated with memory distortion and inconsistency
- Positive induced mood leads to greater “false memory”

Bower’s Network Theory - a theory of emotional experience

- Emotions are nodes in a semantic network
- Emotions stored as propositions
- Emotion = activation of network
- Activation spreads in selective fashion to associated concepts
- When nodes activated above threshold level, conscious experience of emotion results

Four Predictions from Bower’s Theory

- Mood-state-dependent recall
- Mood congruity: learning best when congruity between learner’s state and type of material (best supported)
- Thought congruity: thoughts, associations congruent with mood state
- Mood intensity: increases in intensity (arousal) lead to greater activation of network

Mood Effects on Attention and Memory

- Negative memory bias
  - found with depressed and anxious normals
  - not consistently found with anxious patients (active avoidance?)
- Mood vs. emotion
- Effects on processing capacity (resources allocated to self-talk)

Emotion and Attention

Basis of Dot Probe Results

- Selective attention to threat (McLeod)
- Failure to ‘disengage’ attention from threat (Koster, et al 2004)

Weapon Focus

- Eyewitness’ inability to identify a perpetrator when a weapon is used in a crime
- Easterbrook hypothesis: narrowing of attentional focus in emotional situations
- Arousal and central/peripheral detail

Basis of Weapon Focus

- Simple selective attention
- All items attended to equally, but weapon remembered better
- Cue-utilization (threat-arousal-narrowing)
- Unusualness/distinctiveness

Attention/ Memory in Anxiety and Depression

Emotion and Performance

- Performance impaired by high levels of state anxiety
  - Yerkes-Dodson Law
• performance is optimal with a ‘medium’ level of arousal
  • ‘optimum’ level lower for hard tasks
  - Cognitive Interference theory (Sarason): worry and self-preoccupation interfere
  - Processing Efficiency Theory (Eysenck): processing efficiency = effectiveness/effort;
    worry reduces efficiency
• Performance in depression
  - impaired both by task-irrelevant information and poor effort/motivation
  - most studies are of an anologue nature, though a few patient studies are available

55

56

Anxiety and Attention
• Selective attention toward threat-related material (selective attentional bias; e.g. dot-probe,
  emotional Stroop)
• Distractibility (↓ attentional control)
• Effects on breadth of attention (more local spotlight)
• Interpretive bias: interpreting ambiguous materials as threatening (e.g., “The doctor
  examined little Emily’s growth”)
• Anxiety and preattentive processing

57

Depression
• Little evidence for attentional bias in depression
• Interpretive/recall biases in depression
  - Interpreting ambiguous situations as negative
  - Reduced predictions of success on cognitive tasks
  - Recall of past performance reduced

58

59

60

Discrete v. Dimensional Theories of Emotion

61

Discrete Emotions Theory
• Emotions are distinct and unique states (e.g., fear, anger, etc.)
• ‘Basic’ or ‘primary’ emotions - Tomkins lists 8 (hap, sad, anger, fear disgust, surprise,
  interest, shame)
• Search for response patterning in emotions (Friesen, Ekman, etc.)
• Cross-cultural comparisons

62

63

Biocognitive Theory (Lang)
• Emotions as action predispositions
• Dimensional view of emotions
  – affective valence (appetitive-aversive dimension)
  – arousal (resource recruitment)
• Link between emotional and motivational behavior

64

65

66

Neuropsychological Findings
• Neuropsychological studies of affective competence (RHD)
  • “Modular” organization of affective systems (?)
• Modality-independent affective lexicon
• Valence-related asymmetries

67

68

69

70

71

72
Emotion and the Brain: Three General Hypotheses

- Right Hemisphere dominance for emotion
- Hemispheric laterality for mood
  - Positive/approach: left hemisphere
  - Negative/withdrawal: right hemisphere
- Automatic-controlled distinction (RH v. LH

Localized “Damage” and Emotion

- Awakening from WADA
  - Right Hemisphere: crying, anxiety
  - Left Hemisphere: laughing, excitement
- Acute Structural Lesion (stroke)
  - Right Hemisphere: indifference, ?secondary mania
  - Left Hemisphere: depression (frontal)

Neuropsychiatric Disorders

- Depression
- Secondary Mania
- OCD
- Anxiety
- Aggression/disinhibition
- Psychopathy/APD

Ventromedial Prefrontal Cortex and Somatic Markers

- Somatic marker “biasing signals” are regulated by VM premotor cortex; these signals help regulate decision-making in uncertainty
- Support from Iowa Gambling Task; anticipatory SCR’s to selection of “unfavorable” decks
  - Impaired in VMPFC

Problems with SMT

- Assertion that IGT preferences formed “implicitly” is untenable
- Meaning of psychophysiologial response is unclear (response to feedback, risk indicator, post-decision emotion reaction)
- Not all “normal controls” are normal

Mirror Neuron System

- Class of neurons in F5 (BA 44) and ventral premotor cortex that discharge both:
  - when animal performs object-directed action
  - when animal observes OD action in others
- Subset appear to be “communicative” motor neurons
- Functions
  - Imitation
- Action understanding
  - Potentially important for understanding social learning and imitation effects
  - Being investigated in social-emotional impairments such as autism, Asperger’s disorder, and schizophrenia
  - May be important in “empathy”

**Cortical-Subcortical Interactions in Emotion**
- General concept of limbic system as “emotional effector”
- Question is, “what is the limbic system?”
- Regulatory interaction between cortex and subcortical structures
- Gating
- Selective engagement

**Orbitofrontal Loop**
- Involved in social and emotional functioning
- Damage produces:
  - Disinhibition
  - Hyperactivity
  - Emotional lability
  - Aggressiveness
  - Reduced self-awareness