



THE ROLE OF DYSFUNCTIONAL BELIEFS IN EMOTIONAL REGULATION: EVIDENCE FROM THE BRAIN

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EMOTIONS AND EMOTIONAL REGULATION

- Emotions, a subtype of affect, are flexible response sequences elicited by internal or external events *appraised* as relevant to an organism's well-being (Gross, 1998).
- Emotional regulation: methods of influence relating to the experience and expression of emotions, as well as the times in which emotions occur (Rottenberg & Gross, 2003)



THE NEED OF NEUROBIOLOGICAL EVIDENCE

- Can contribute to an **integrative, multilevel** understanding of emotion regulation (i.e. not only at the behavioral and subjective/emotional level, but also at the implementational level- neurobiological).
- Could potentially inform the **development of pharmaceutical treatments** for disorders that involve problem in emotional regulation. According to Gross and Levenson (1997), a review of the Diagnostic and Statistical Manual of Mental Disorders, fourth edition ([DSM-IV]) reveals that over 50% of Axis I disorders and 100% of Axis II disorders implicate emotion regulation deficiencies.



PERSPECTIVES ON EMOTIONAL REGULATION

- Research oriented approaches

Process Model of Emotion Regulation (Gross, 1998, 2001)

Affective Style (Davidson, 1998, 2000)

- Clinically orientated approaches

Stress-Coping Paradim (Lazarus, 1966; Lazarus & Folkman, 1984) followed by developments in cognitive behavioral therapy (CBT):

Integrative Cognitive Model of Emotions (David & Szentagotai, 2006)

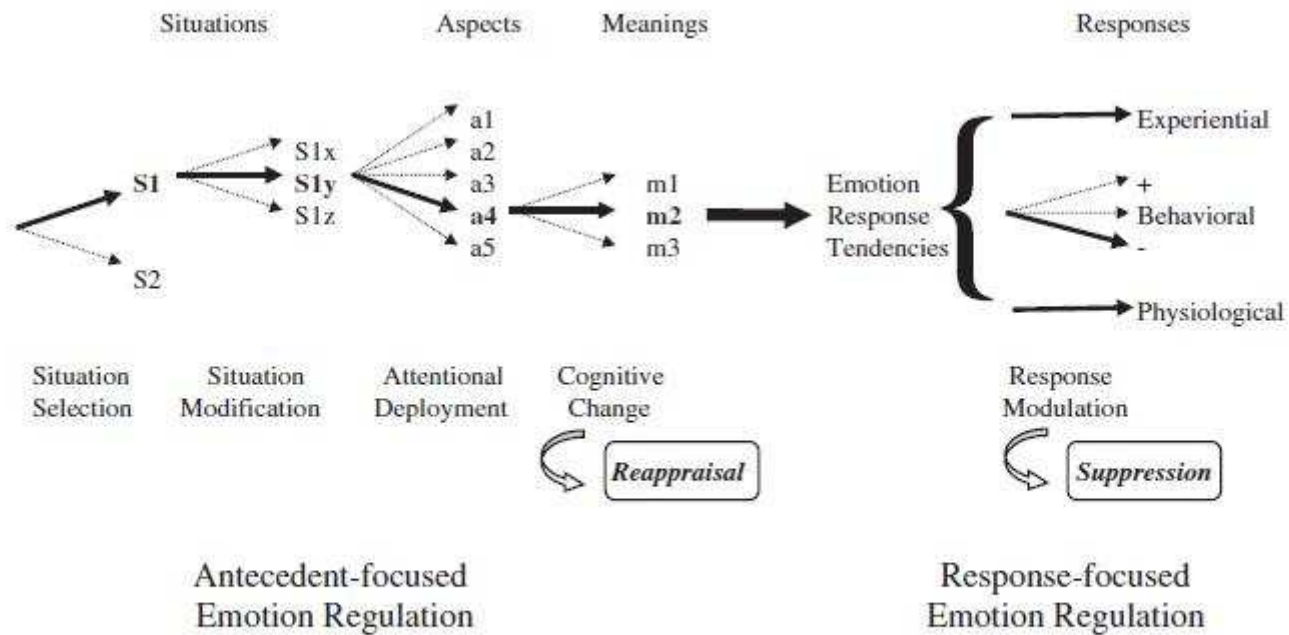


PROCESS MODEL OF EMOTION REGULATION

- Gross, 1998, 2001; Gross & John, 2002
 - An emotion begins with an evaluation of emotion cues.
 - When attended to and evaluated in certain ways, emotion cues trigger a coordinated set of response tendencies that involve experiential, behavioral, and physiological systems.
 - Once these response tendencies arise, they may be modulated in various ways. Because emotion unfolds overtime, emotion regulation strategies can be distinguished in terms of when they have their primary impact on the emotion-generative process.



PROCESS MODEL OF EMOTION REGULATION (Gross, 1998, 2001)



EMOTIONAL REGULATION STRATEGIES

- Gross, 1998: antecedent-focused and response-focused regulation strategies
- Antecedent focused: occur early on in the emotion generation process, before the emotion has been fully generated and allow for alteration of the emotional trajectory, influencing both the experience and subsequent expression of the emotion
- SITUATION SELECTION SITUATION MODIFICATION
- ATTENTIONAL DEPLOYMENT REAPPRAISAL



EMOTIONAL REGULATION STRATEGIES

- **Response focused:** occur later in the emotion generation process, and thereby allow fewer opportunities for intervention. As the emotion is fully generated, response-focused strategies tend to focus on alteration of the expressional component of the emotion, rather than the experiential and physiological components

SUPPRESSION



NEUROBIOLOGICAL STUDIES

- **Ochsner & al., 2002:**

- Task: Reappraise vs Attend for emotionally negative pictures (38); Attend for neutral pictures (38); fMRI

- Participants: 15 right-handed females

- Results:

1. Reappraisal was successful in reducing negative emotions correlated with increased activation in the LPFC and MPFC and decreased activation in the MOFC and the amygdala (modulates their activity).
2. This would imply reappraisal influences processes involved in evaluating the affective salience of the stimuli & the salience of that stimuli in the context of the current situation or personal goals
3. Overlapping prefrontal regions support the cognitive regulation of feelings and emotions

NEUROBIOLOGICAL STUDIES

- **Ochsner & al., 2004**
- Task: to increase vs decrease vs respond naturally to their negative emotions to aversive pictures by using a situation-focused vs a self-focused approach; fMRI
- Participants: 24 female participants
- Results:
 1. Down-regulation deactivated amygdala bilaterally (but more significantly on the left), while up-regulation increased activation of left amygdala
 2. Up-regulation relied on left rostral medial and posterior cingulate cortices (generating words describing emotional events)
 3. Down-regulation relied on right LPFC (behavioral inhibition, interference resolution) & right OFC (altering and updating the context-sensitive motivational relevance of stimuli)



NEUROBIOLOGICAL STUDIES

- **Johnstone & al., 2007**
- Task: In the MRI scanner: To increase vs decrease vs attend to their emotional response to emotionally positive and emotionally negative pictures
- Participants: 21 MDD patients (medication free) compared to a matched for sex and gender non-depressed group (18)



NEUROBIOLOGICAL STUDIES

- **Johnstone & al., 2007**

- Results:

1. Left-lateralized activation in the prefrontal cortex (PFC) when down-regulating negative affect in non-depressed individuals, whereas depressed individuals showed bilateral PFC activation.
2. During reappraisal task, nondepressed individuals showed an inverse relationship between activation in left ventrolateral PFC and the amygdala that is mediated by the ventromedial PFC (VMPFC). No such relationship was found for depressed individuals, who instead show a positive association between VMPFC and amygdala.
3. Pupil dilation data suggest that those depressed patients who expend more effort to reappraise negative stimuli are characterized by accentuated activation in the amygdala, insula, and thalamus, whereas nondepressed individuals exhibit the opposite pattern.



AFFECTIVE STYLE AND PSYCHOPATHOLOGY

- Davidson (1998, 2000) has defined affective style as *valence-specific features of emotional reactivity and affective responding*.
- Specific parameters of affective style can include: threshold to respond, magnitude to respond, rise time to peak of response, recovery function of response, duration of response.
- Individual differences in these parameters can explain differential vulnerability to psychopathology (e.g. specific mood and anxiety disorders can result from failure to turn off a response sufficiently quickly or an abnormally early onset, surpassing normal regulatory constraints)



AFFECTIVE STYLE AND PSYCHOPATHOLOGY

- Davidson (1998, 2000, 2003) has shown that that activation asymmetries in the prefrontal cortex (PFC) contribute to individual differences in affective style.
- Specifically
 - The dominance of *left PFC* has shown to be linked to approach motivation (positive emotions)
 - The dominance of the *right PFC* has shown to be linked with withdrawal motivation (negative emotions)
- Activation asymmetry= *diathesis model* (alters the probability that certain forms of emotional reactions will occur *in response* to environmental challenges)



AFFECTIVE STYLE AND PSYCHOPATHOLOGY

- Amygdala – another contributor to individual differences in affective style
- PFC-amygdala circuit sustains emotional regulation
- Questions left unanswered:
 - Implicated in all emotions or just negative affect (most specifically fear)?
 - Reliable functional asymmetries in the region?
 - Required for ongoing expression of affect or initial acquisition of emotional learning?



EMOTIONAL REGULATION

- Emotional regulation= key component of affective style and of vulnerability to psychopathology
- ? Which methods of emotional regulation are more efficient and do they operate by different processes? (behavioral question)
- ? What neural systems (involving the PFC – amygdala relationships) underpin these methods and are they functionally distinct? (neurobiological question)



INTEGRATIVE COGNITIVE MODEL OF EMOTIONS

- David & Szentagotai, 2006
 - Building on other models of emotion (e.g. Lazarus, 1991; Wessler, 1982) and reviews of developments in cognitive behavioral therapies.



BASIC ASSUMPTIONS OF COGNITIVE BEHAVIOR THERAPY

- Psychopathology (emotional problems) is the result of *dysfunctional thinking patterns* about events (Ellis, 1955, 1994; Beck, 1979, 2005)
- These are defined as non-logical, non empirical and functionally detrimental to the client
- Thus, the way to *modify* the emotional problems is by modifying dysfunctional beliefs by means of *cognitive restructuring* (challenging them and teaching the client their functional counterparts).
- Cognitive restructuring entails deep level modifications of cognitions (one way to do it experimentally is by using cognitive self-statements, see Cramer, 2005)

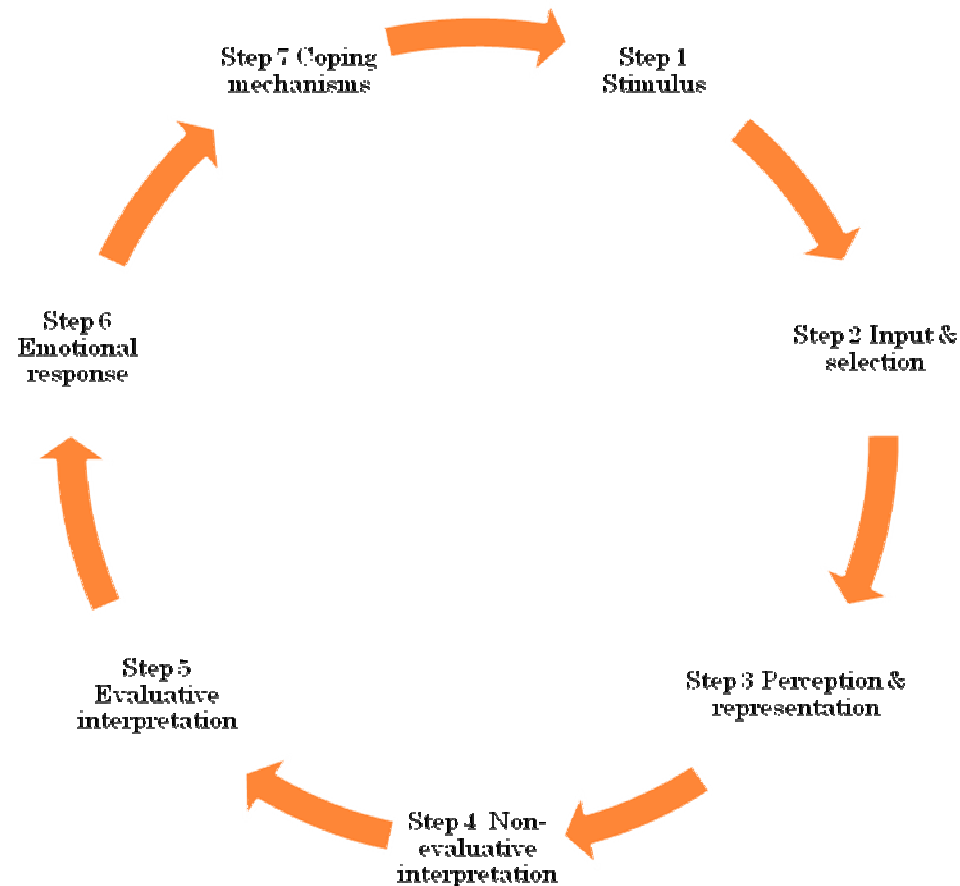


INTEGRATIVE COGNITIVE MODEL OF EMOTIONS

- According to Lazarus and Smith (1988), **cold cognitions** refer to the way people develop representations of relevant circumstances (i.e., about activating events).
- **Hot cognitions** refer to the way people further process cold cognitions.
- **Appraisal** or evaluative (hot) cognitions are used to define how cold cognitions are processed in terms of their relevance for personal well-being (Ellis, 1994; Lazarus, 1991)



INTEGRATIVE COGNITIVE MODEL OF EMOTIONS (David & Szentagotai, 2006)



INTEGRATIVE COGNITIVE MODEL OF EMOTIONS

○ Step 1: Stimulus

- Anything that can influence the activity of our sensorial systems (simple or complex, overt or covert)

○ Step 2: Input and selection

- Individuals selectively attend to supraliminal stimuli, ignoring many of the potential stimuli in the environment (cognitive inhibition)

○ Step 3: Perception and symbolic representation of the stimulus

- A cognitive step, it can be divided into definitions (the perception) and descriptions (symbolic representation of perceptions).



INTEGRATIVE COGNITIVE MODEL OF EMOTIONS

- Step 4: Non-evaluative interpretation of the symbolic representation of the stimuli
 - Inferences about unobserved aspects of the perceived stimulus or about one's mental images. They go beyond immediately observable facts, including such cognitive activities as logical operations, forecasts and expectations, attributions (i.e. *cold cognitions*)
- Step 5: Evaluative interpretations of processed stimuli
 - Consists of *hot cognitions*. If the appraisal is neutral, ambiguous, or indecisive, no affective response follows.



INTEGRATIVE COGNITIVE MODEL OF EMOTIONS

- Step 6: Emotional response to processed stimuli
 - Feelings are hypothesized to follow non-neutral appraisals of stimuli (or images).
- Step 7: Coping mechanisms to feelings experienced at step 6
 - Coping mechanisms (e.g., cognitive, behavioral, physiological, emotional) aim to deal with feelings generated at step 6. For example, there is an automatic tendency for coping to accompany feelings based upon appraisals at step 5



NEUROBIOLOGICAL STUDIES

- **Schaefer & al., 2003**
- Task: In the PET scanner:
To mentally imagine a given scenario and then to mentally repeat sentences regarding a way to reappraise the scenario (schematic vs propositional)
- Scenarios selected from the ISEAR database (Scherer et al., 1994) for anger, sadness, happiness, affection
- Participants: 20 subjects
- **Definition in task:**
 - *Schematic mode:*
metaphorical, holistic sentences reflecting a spontaneous mode of reappraising the situation (e.g. *everything collapses around me*)
 - *Propositional mode:*
explicit, analytic questions about specific elements of the scenario were used (e.g. *is this situation important for me?*)



NEUROBIOLOGICAL STUDIES

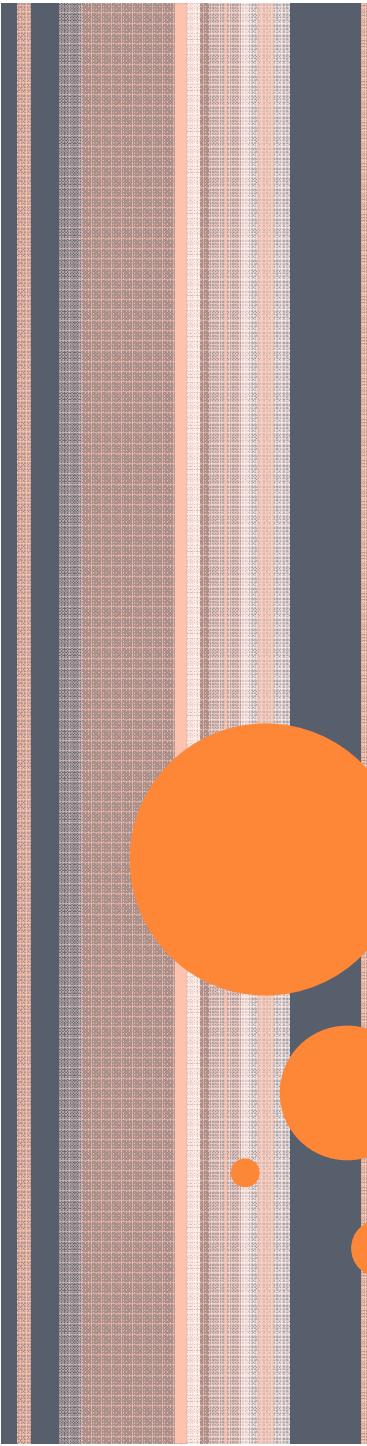
- **Schaefer & al., 2003**
- **Results:**
- The results supported the hypothesized distinction between schematic (“hot” processing - spontaneous reappraisal) and propositional emotional (“cold” processing – controlled processing of declarative knowledge about emotion) processing modes.
- Specifically, schematic mode was associated with increased activity in the ventromedial PFC (emotional generation) whereas propositional mode was associated with activation of the anterolateral PFC (executive functions, inhibition).



OUR OWN RESEARCH

- Carried out in collaboration between Babes-Bolyai University, University of Pisa, Italy and CNR, Pisa, Italy
- fMRI and EEG studies aimed at unifying the models presented
 - Focus on the status of dysfunctional thinking as a process in emotional generation and regulation
 - Relate dysfunctional beliefs to brain activity correlates, using fMRI and EEG methods
- Study implementation and preliminary results





THANK YOU FOR YOUR
ATTENTION