Staying cool when things get hot: fMRI comparison of two regulation strategies

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INTRODUCTION

- Emotion regulation refers to the modulation of the behavioral, experiential, and physiological aspects of emotion.
- In Reappraisal, the individual cognitively changes the meaning of the stimulus while in expressive Suppression, the individual refrains from showing any emotional response on his or her face.
- Previous work has suggested that reappraisal is superior to suppression in reducing the impact of negative affect (1).
- In the present study, healthy young adults engaged in reappraisal, suppression, or attended to emotional and neutral pictures while undergoing event-related fMRI.
- We hypothesized reduction in amygdala and insular activity, as well as increased prefrontal cortex activity and positive valence ratings during the reappraisal condition, reflecting reduction in negative experience.

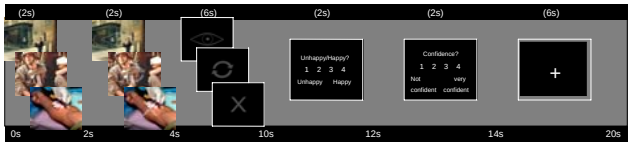
METHODS

Experimental Design

- 120 negative and 40 neutral IAPS slides presented in an event-related design
  - 40 negative look
  - 40 negative reappraise
  - 40 negative suppress
  - 40 neutral look

Summary of subjects

No. of Subjects	18
No. Female/Male	8/10
Age (+-SD)	21(+-2.4)



- Subjects were instructed to perform one of 3 tasks: "look" at the picture, "reappraise" the picture, or "suppress" the picture.

The instruction was presented as a symbol:

= look **= suppress** **= reappraise**

- Subjects underwent a training session prior to engaging in the task. They were instructed to engage in each strategy aloud while the experimenter made corrections/suggestions and confirmed successful application of each strategy.

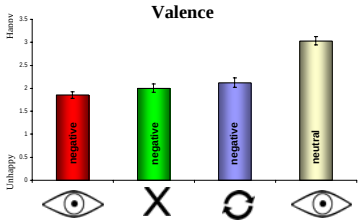
IMAGE ACQUISITION & ANALYSIS

- General Electric 4T scanner
- Inverse Spiral; TR=2 sec; TE=31 msec; Flip=60º
- Voxel size 3.75 x 3.75 x 3.8mm; 34 slices parallel to AC-PC line (24 cm FOV)
- Data were preprocessed using FSL. Voxel-based analyses used custom software
  - Group analysis and contrasts were conducted by extracting and averaging peak timepoints within each subject for negative look, negative reappraisal, negative suppress, & neutral look epochs. T statistics were then submitted to a random effects analysis for each contrast.
  - Percent signal change was extracted from ROIs based on random effects group analysis (fitted to the canonical HDR template) of the negative look condition.

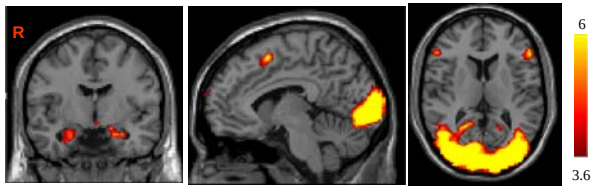
RESULTS

1 Negative valence was reduced during the reappraisal condition in comparison to the negative look condition.

Subjects were more unhappy when instructed to **look** at negative pictures relative to the **suppress** condition ($p<0.01$) and **reappraise** condition ($p<0.002$). Reappraise was associated with marginal reduction in negative affect relative to suppress ($p = 0.07$).

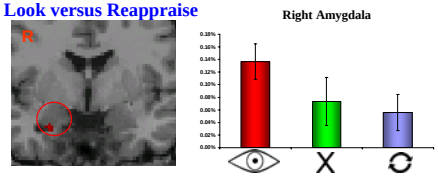


2 When subjects viewed aversive pictures, activation was observed in a network of regions including the amygdala, anterior cingulate, and bilateral inferior prefrontal cortex

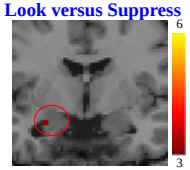


3 By employing an emotion regulation strategy, activity was reduced in right amygdala.

Look versus Reappraise

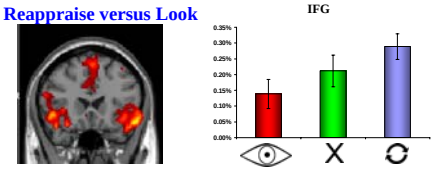


Look versus Suppress

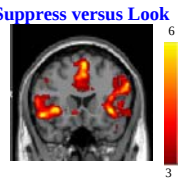


Activity was also increased in IFG and anterior cingulate by employing an emotion regulation strategy.

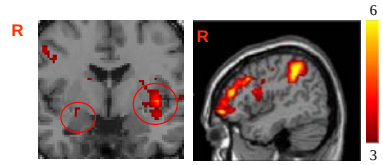
Reappraise versus Look



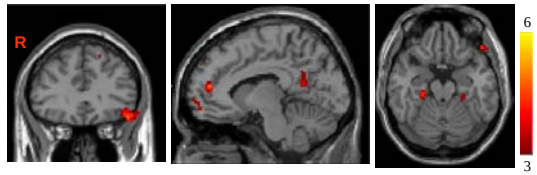
Suppress versus Look



4 Direct comparison of the two emotion regulation strategies showed that suppress was associated with greater activity in the right amygdala, insula, right IFG, and parietal cortex



The reappraise vs. Suppress contrast showed greater activity in left IFG, ACC, medial PFC, and parahippocampal gyrus



CONCLUSIONS

These results provide evidence for the beneficial effect of emotion regulation in reducing the impact of negative emotion and further suggest that reappraisal may be superior to expressive suppression in reducing negative affect via engagement of distinct neural circuitry. We showed the following:

- Subjects showed enhanced negative experience when viewing negative pictures in contrast to neutral pictures. Importantly, negative valence was reduced when subjects were instructed to regulate their emotion, with a trend towards greater reduction from reappraisal than suppression.
- When instructed to engage in emotion regulation, subjects showed decreased activity in the amygdala and increased activity in prefrontal cortex and anterior cingulate. The prefrontal regions are consistent with regions previously implicated in cognitive control processing.
- When subjects reappraised versus suppressed, greater activity was observed in left IFG, ACC, medial PFC, and bilateral parahippocampal gyrus. Several of these regions have previously been implicated in inhibitory control of the amygdala (2) and controlling the impact of distracting emotions (3).
- Conversely, when instructed to suppress, subjects showed greater activity in amygdala, insular cortex, right IFG, and parietal cortex. Some of these regions are involved in enhanced negative emotional experience (4) and inhibitory control of visceral and motor function (5).

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