



Emotions, Decision Making and the Brain

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Definitions

■ Regret

- the feeling that occurs when one's outcome is worse than the alternative outcome if one had chosen differently
- *"I wish I have chosen differently."*
- Positive counterpart: Rejoice

■ Disappointment

- the feeling that occurs when one's outcome is worse than the hoped for outcome
- *"I wish the outcome was better."*
- Positive counterpart: Elation

Consumer research--behavioral effects

- Emotions such as regret and disappointment have received relatively limited research attention in JDM and in behavioral decision theory
- Regret and disappointment may differentially impact a consumer's satisfaction, loyalty, probability of switching brands, etc.

Literature and Current Research Question

- Some models of choice include the anticipation of regret and disappointment as “parameters” in predicting current choice
 - Minimax, regret theory, decision affect theory, decision justification theory
- We are interested in understanding the experience of regret and disappointment
 - Does the emotional state of regret or disappointment from the current choice influence subsequent choice?
 - That is, not just anticipated but experienced

Current Research Question

- To capture current regret and disappointment we need to characterize the “signature data pattern”
- Self-report and behavioral data have not worked in the past
 - Both are negative emotions (typical ceiling effects)
 - Do not do well at predicting future choice
- We conjecture that an imaging paradigm would allow us to characterize the “signature effect” for regret and disappointment
 - Previous patient study and one imaging study
 - Regret implicates “self” more than disappointment

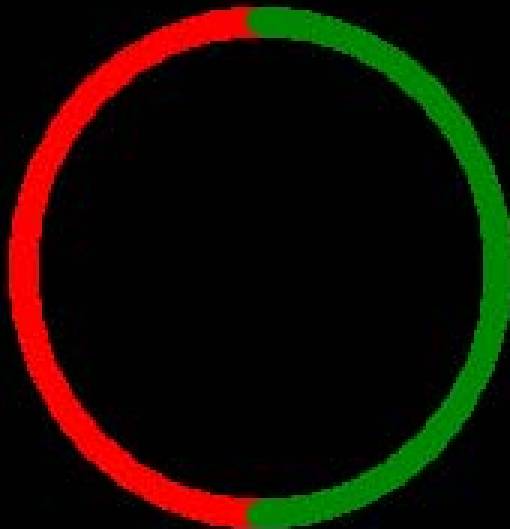
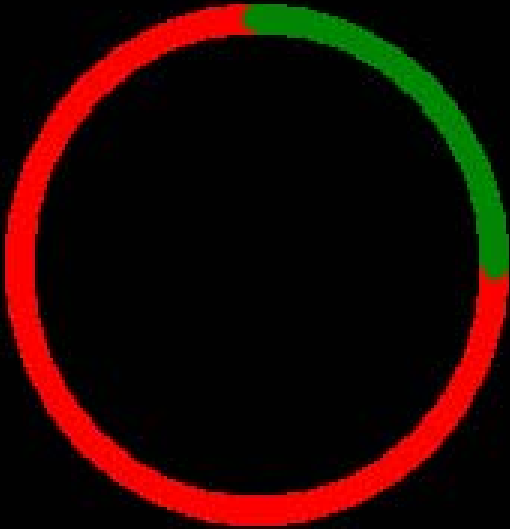
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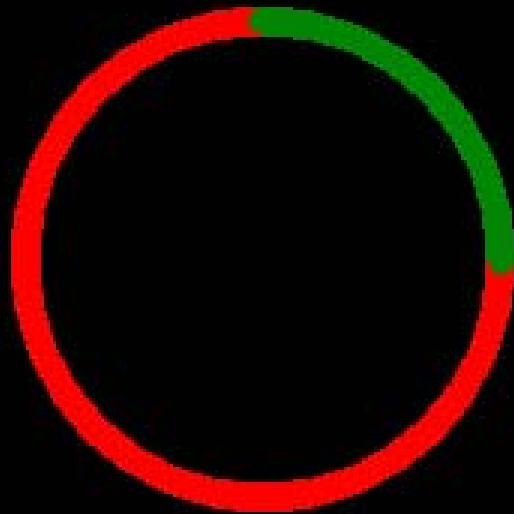
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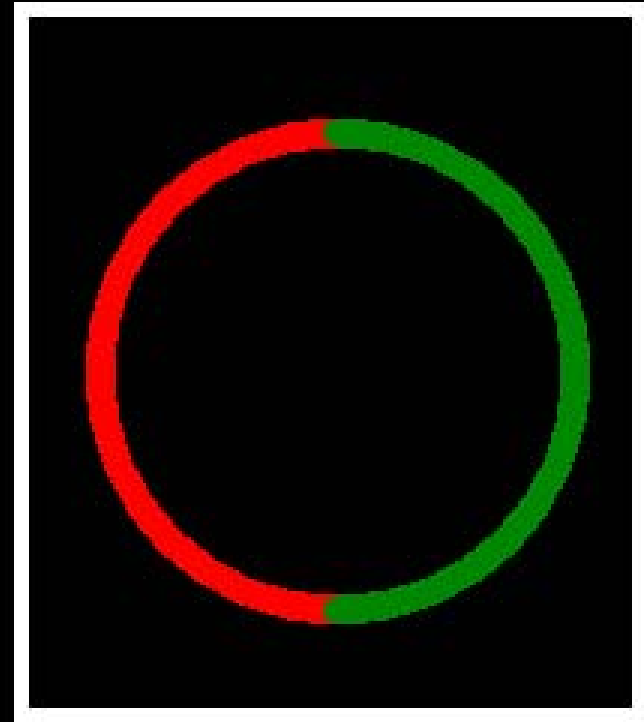
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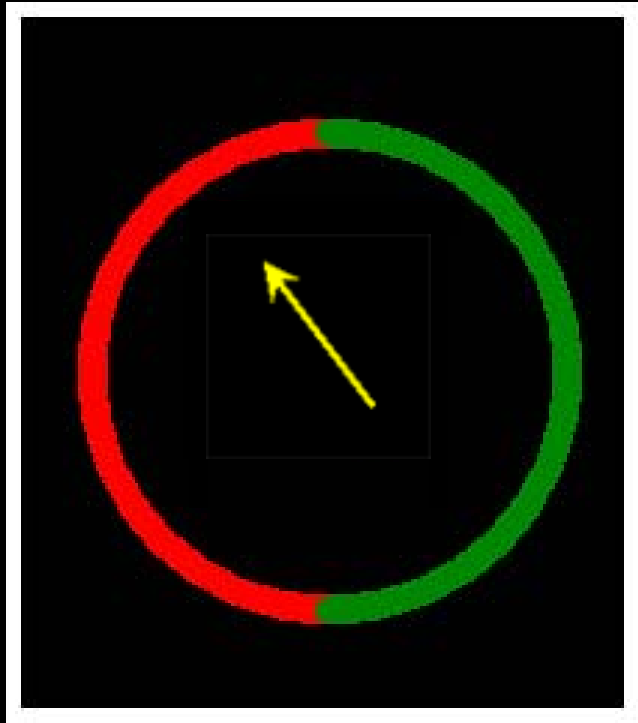
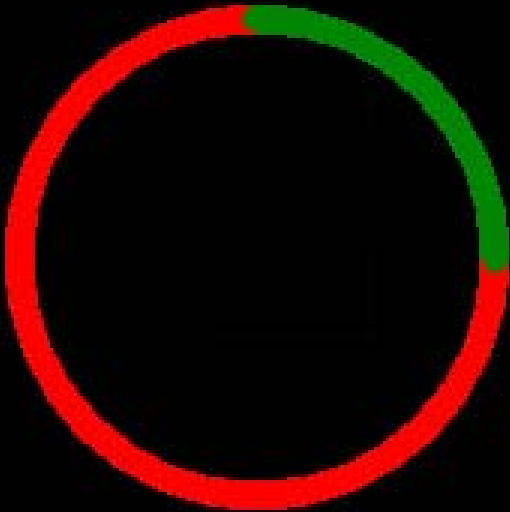


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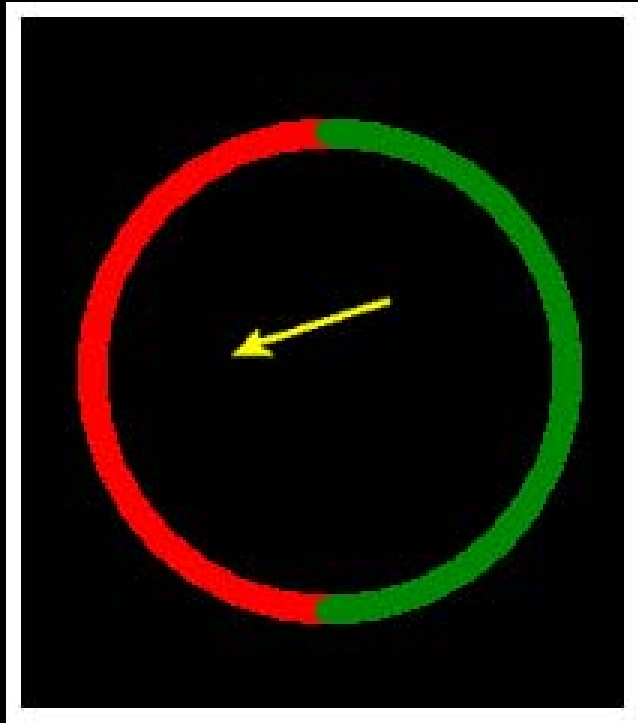
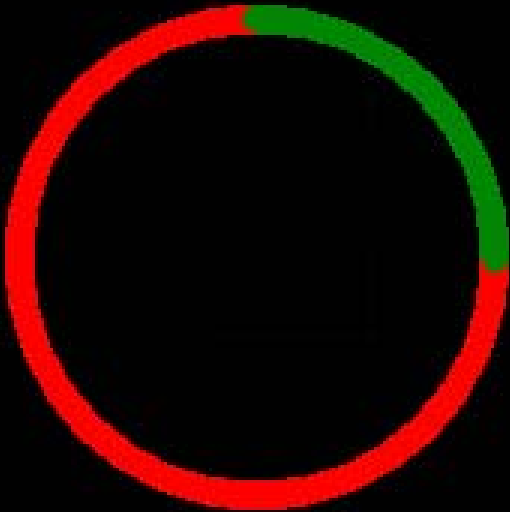


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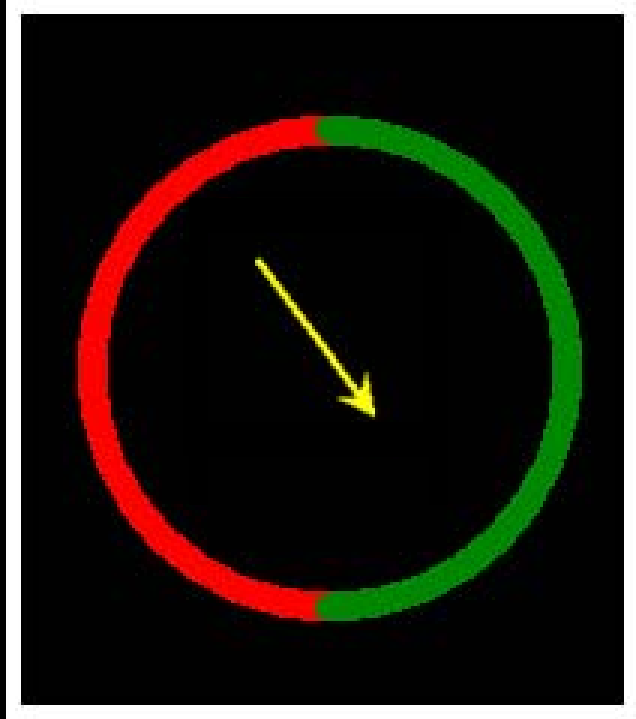
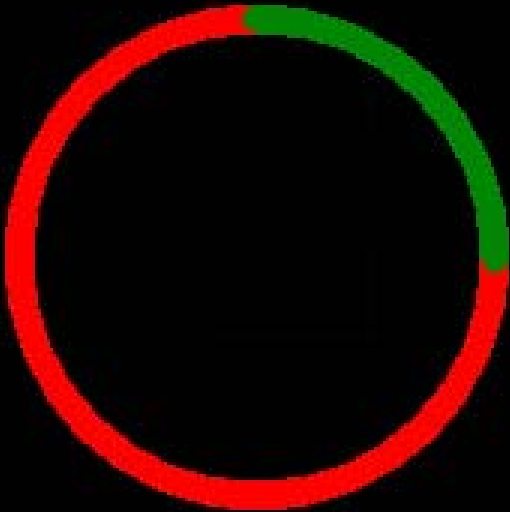
Disappointment
(Partial Feedback)

-15

+85

-30

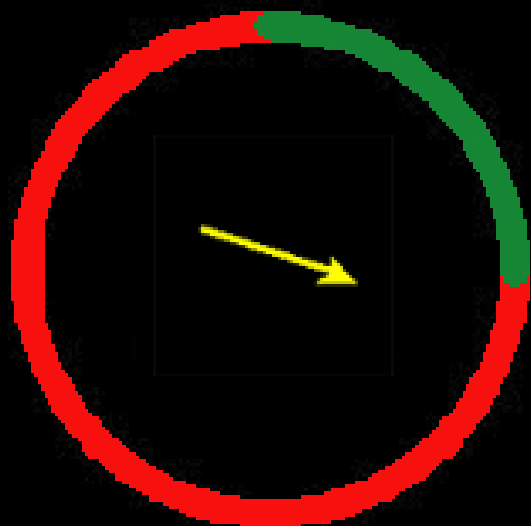
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Elation
(Partial Feedback)

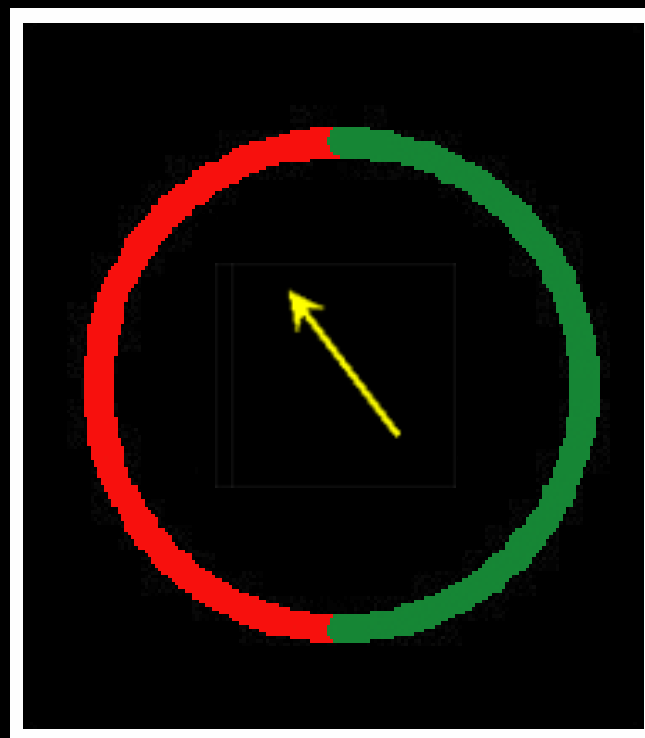
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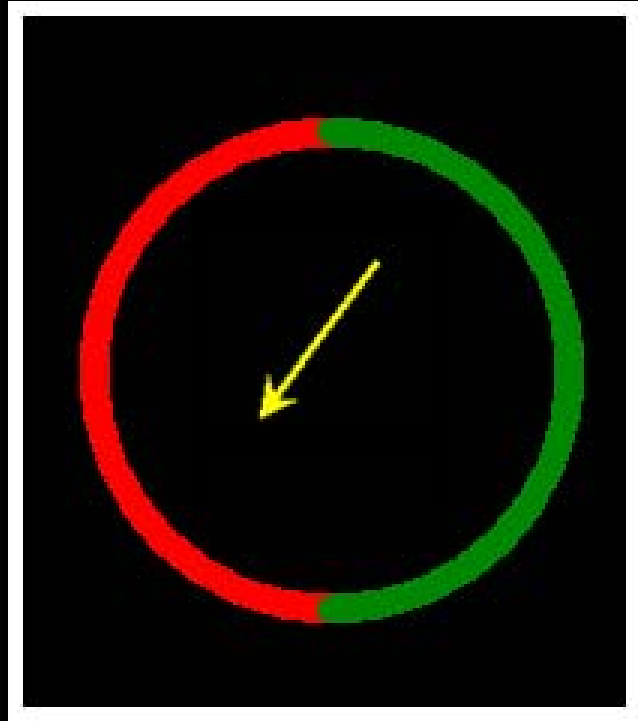
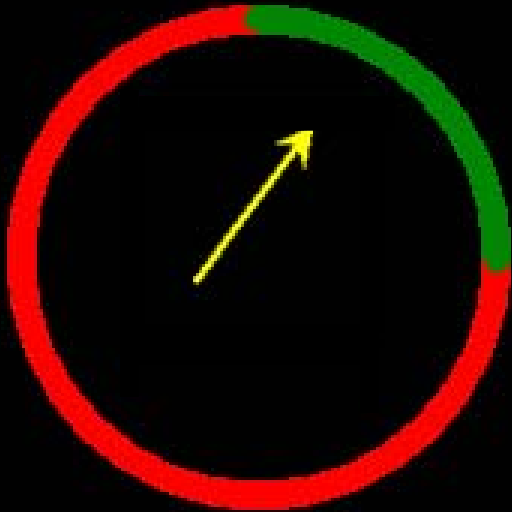


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Regret
(Full Feedback)

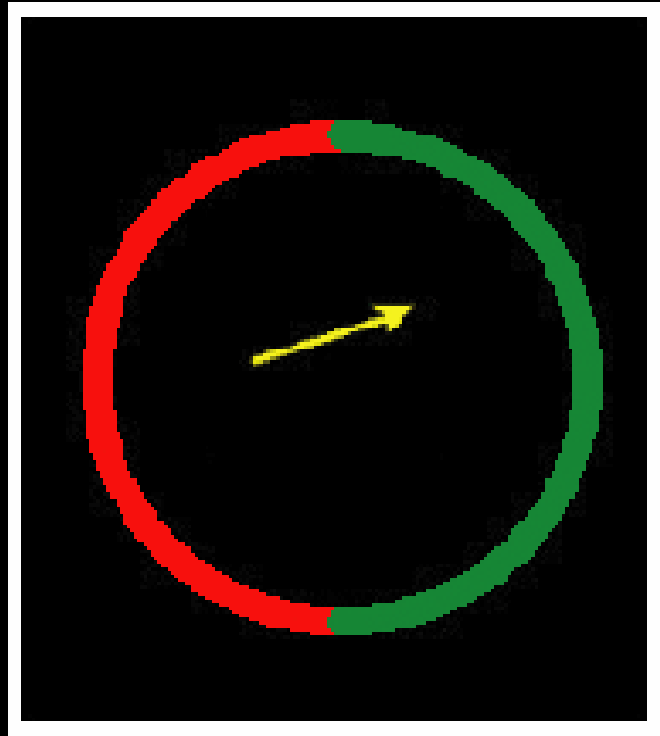
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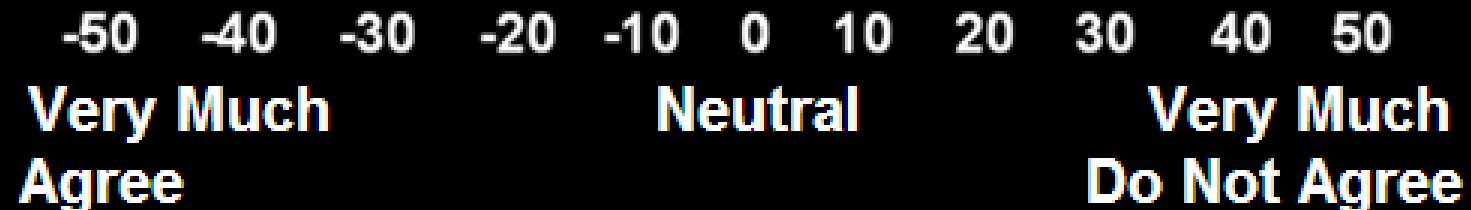
+50



Rejoice
(Full Feedback)

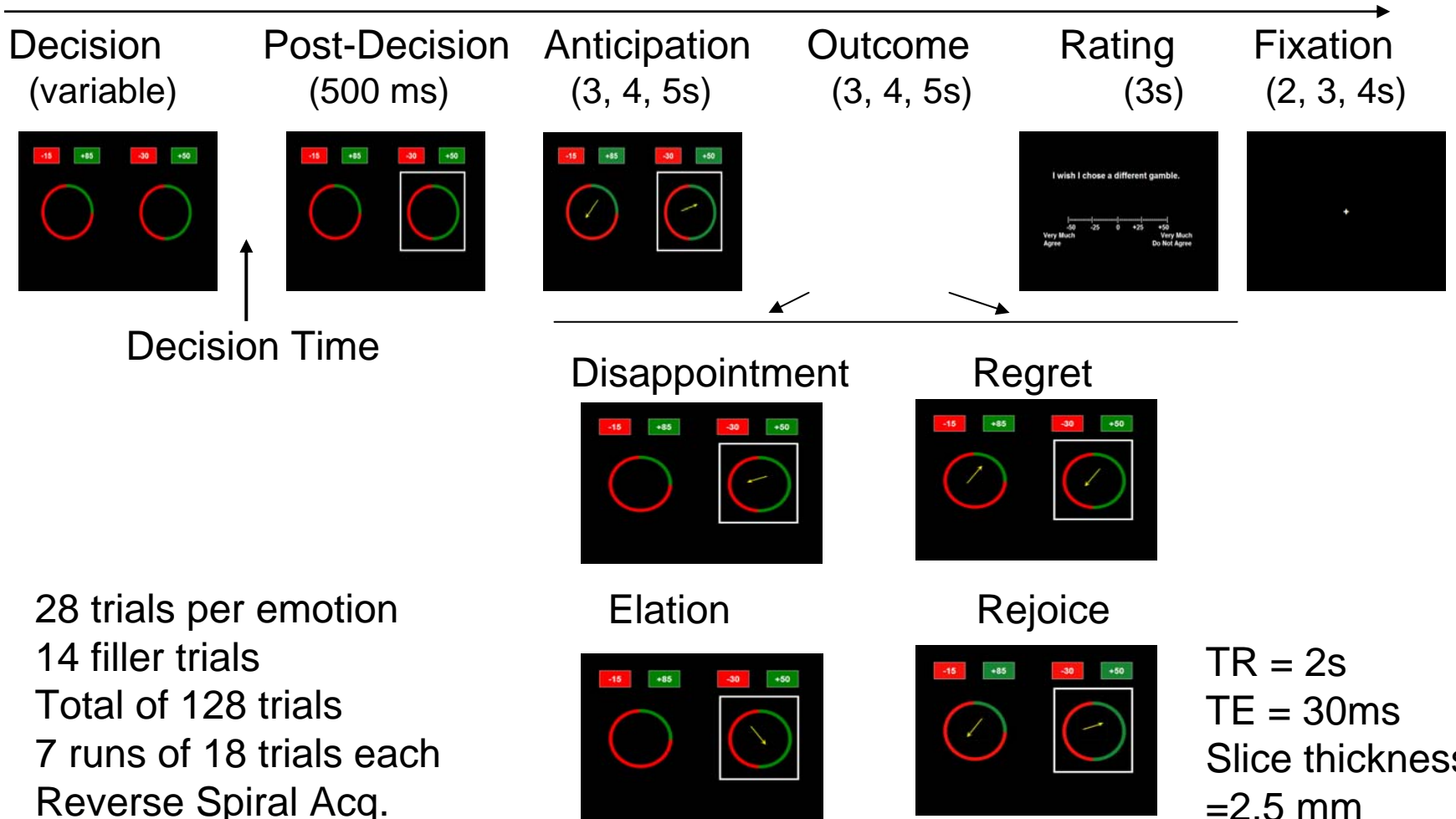
I wish I chose a different gamble.

x



Method

time



28 trials per emotion
 14 filler trials
 Total of 128 trials
 7 runs of 18 trials each
 Reverse Spiral Acq.

TR = 2s
 TE = 30ms
 Slice thickness
 =2.5 mm
 Slices = 40

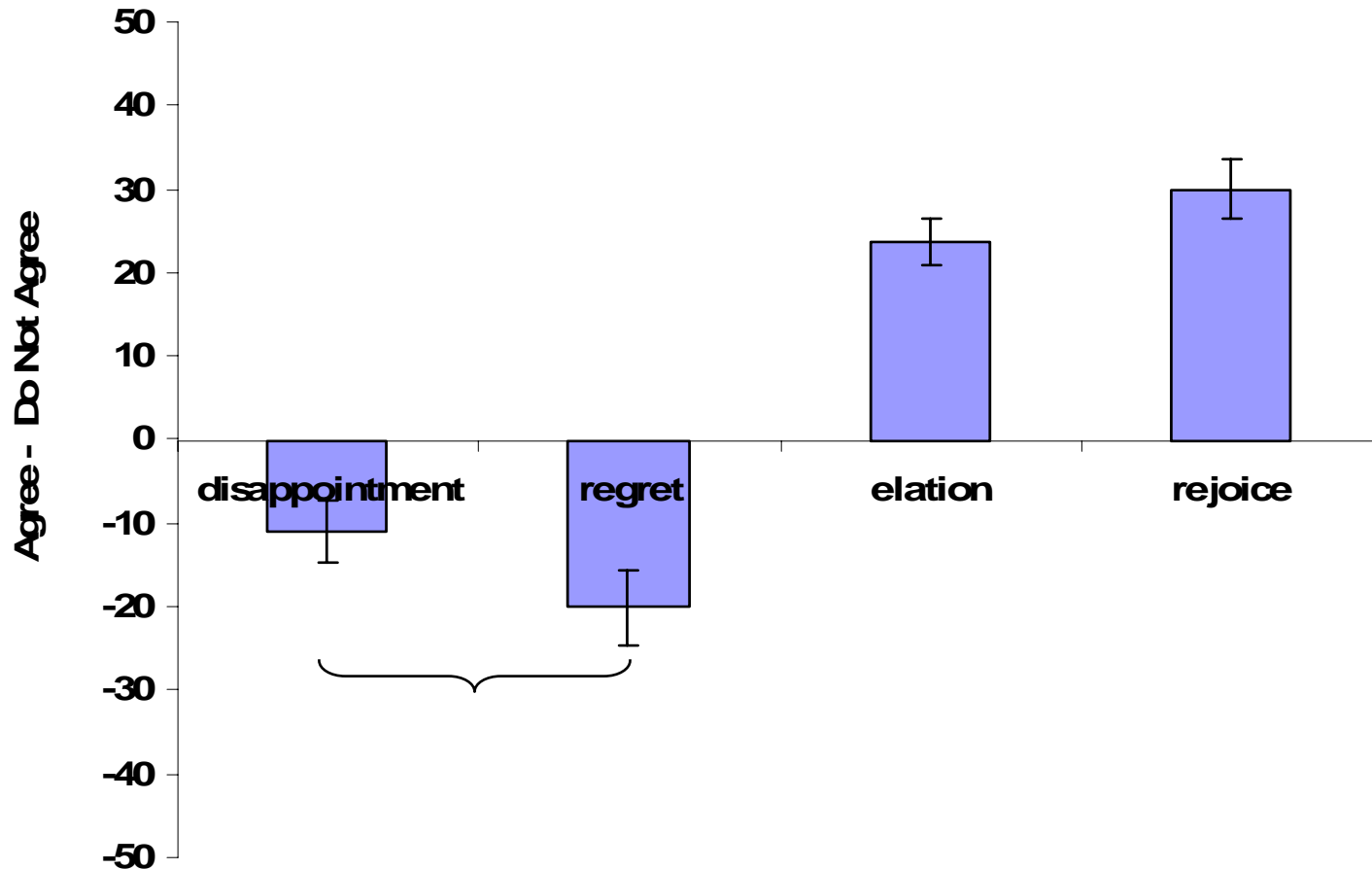
Stimuli

- Probability levels: .1, .25, .5, .75, .9
- Outcomes: ranged from -90 to +90
- Dense design to allow estimation of relevant decision parameters (e.g., utility, decision weight, decision affect parameters, etc)
 - will allow theory testing because behaviorally relevant parameters can be associated/dissociated with brain activity
- Participants paid actual payoffs by converting points to cash (mean \$45 over two hours)

Study 1:

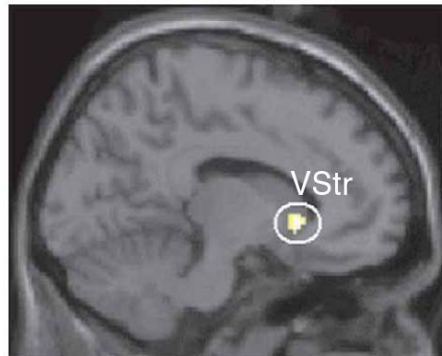
Participants wished they chose a different gamble more after regret

I wish I chose a different gamble.

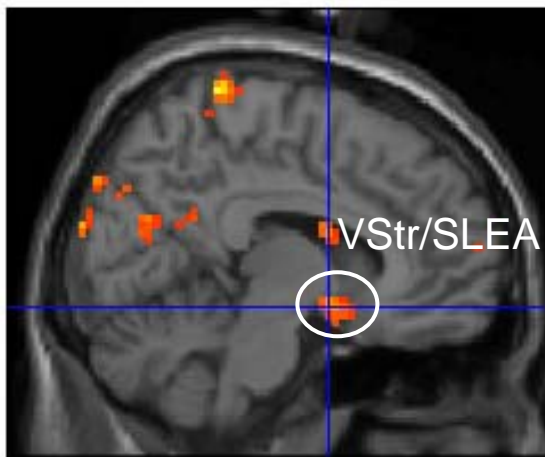


Positive vs. Negative Emotions

Ventral Striatum

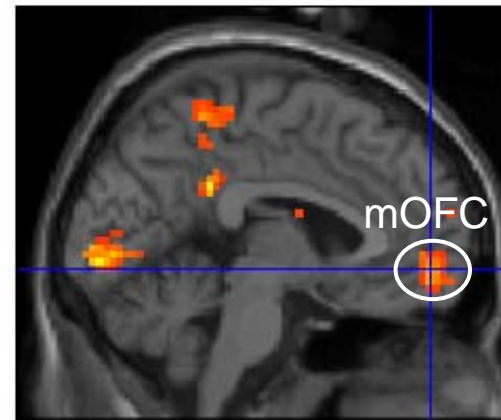


(Coricelli et al., 2005)

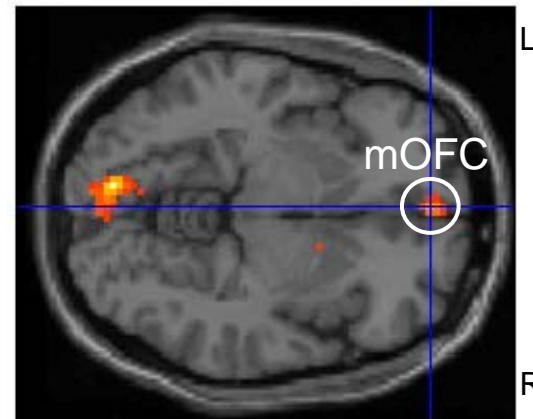


(9, 3, -9) Z = 3.80

Medial Orbitofrontal Cortex



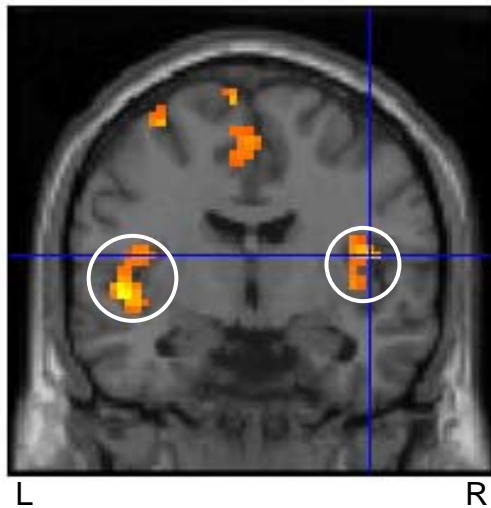
BA 10 (-3, 54, -6)
Z = 3.75



(Rejoice + Elation) - (Regret + Disappointment)

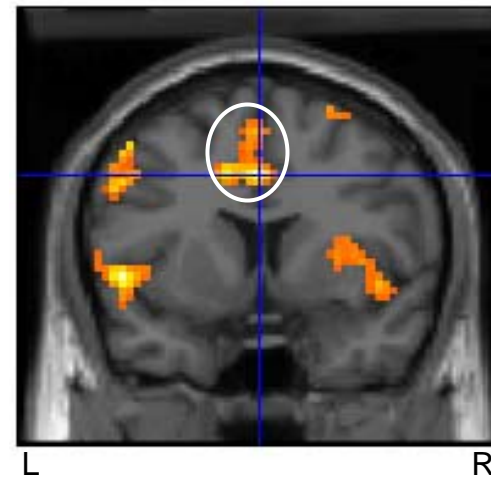
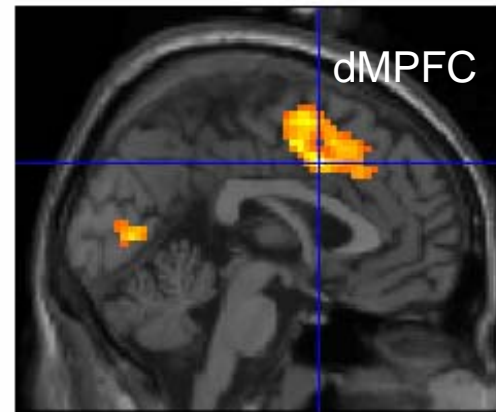
Regret vs. Fixation

Anterior Insula

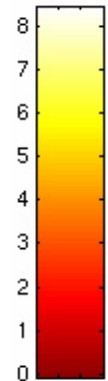


BA 13 (-42, -12, 12) $Z = 3.36$
BA 13 (45, -6, 12) $Z = 3.61$

Dorsomedial Prefrontal Cortex

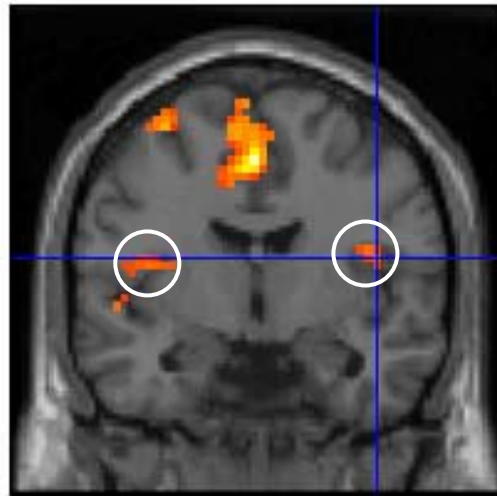


BA 32, BA 6 (0, 9, 39) $Z = 4.32$



Disappointment vs. Fixation

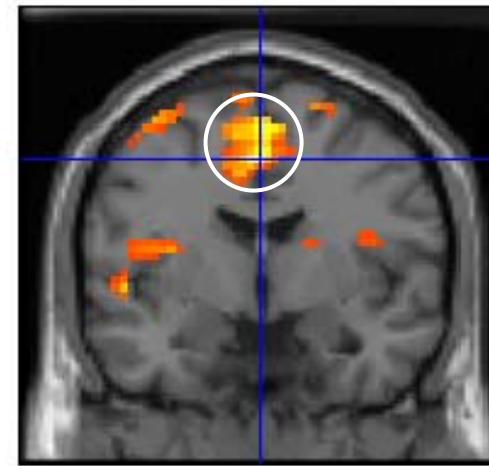
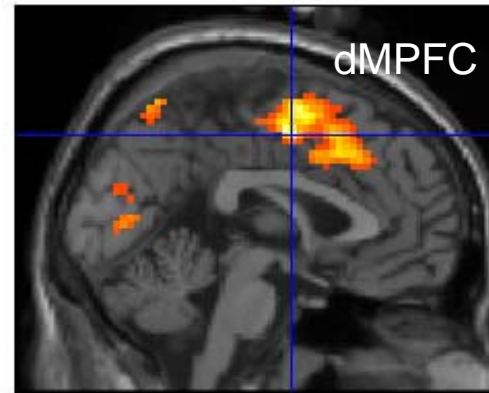
Anterior Insula



L R

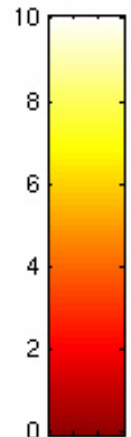
BA 13 (45, -6, 15) Z = 3.18

Dorsomedial Prefrontal Cortex



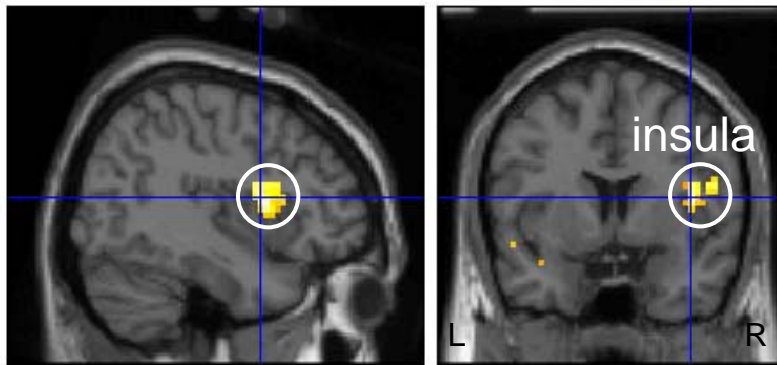
L R

BA 6, 32 (0, -3, 48) Z = 4.86



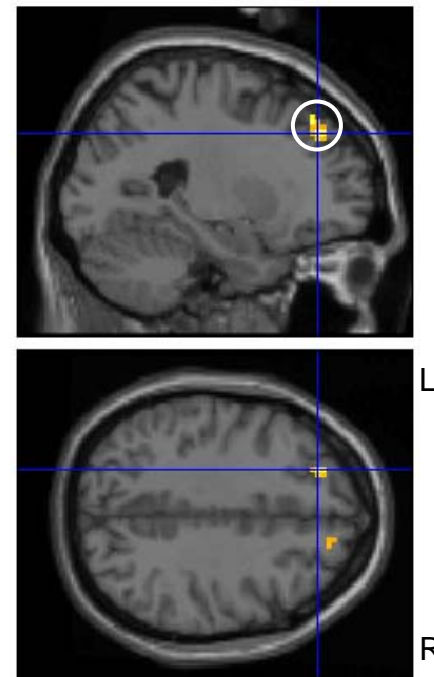
Regret vs. Disappointment

Anterior Insula



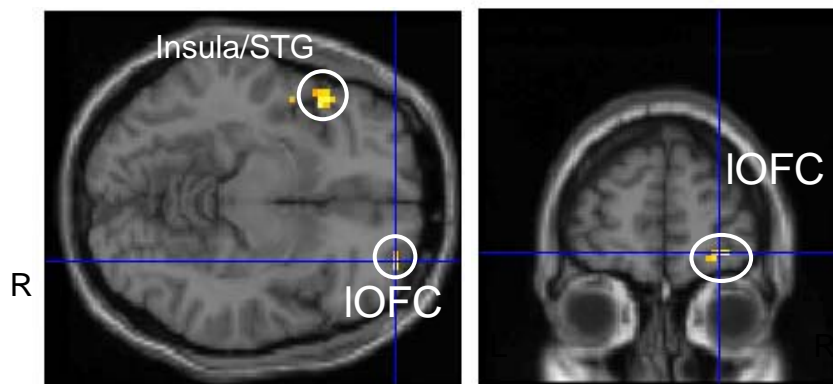
R ant insula--BA 13 (42, 6, 18) Z = 3.80

BA 8



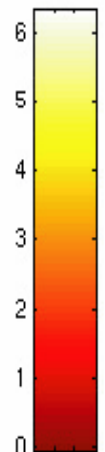
BA 8(-24, 39, 39) Z = 3.74

L Lateral Orbitofrontal Cortex



IOFC, BA 10 (30, 57, -9) Z = 3.50

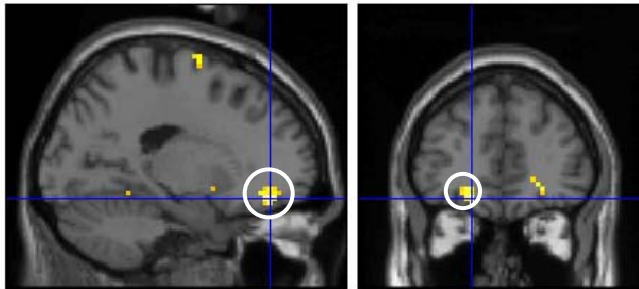
L Insula/STG/IFG, (-45, 18, -9) Z = 3.36



Difference Score as a Regressor to the Outcome

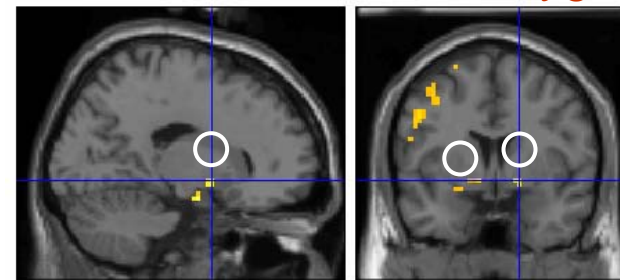
- difference between what you received and could have received

Lateral Orbitofrontal Cortex

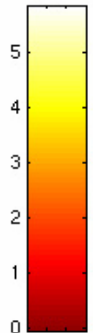


BA 11 (-18,42, -15), $Z = 3.70$
BA 11 (27, 45, -9), $Z = 3.31$

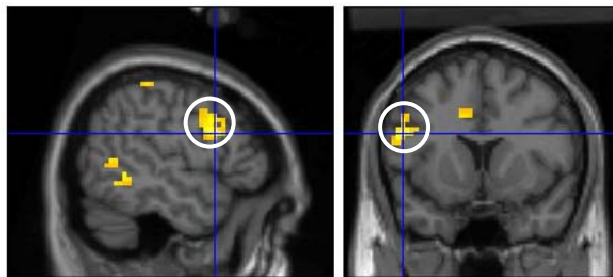
Sublenticular Extended Amygdala



(18, 3, -6), $Z = 3.17$
(-12, 0, -9), $Z = 3.07$



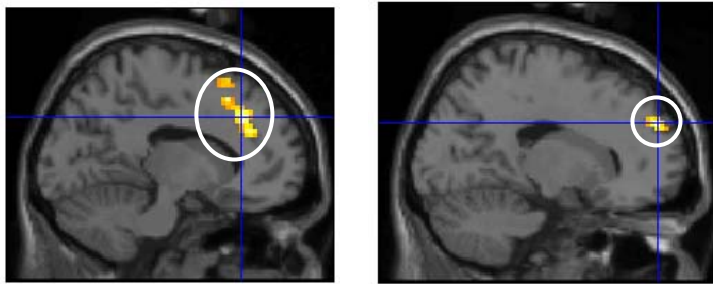
Dorsolateral Prefrontal Cortex



BA9 (-51, 12, 24), $Z = 3.55$

Subjective Ratings as Regressor to the Outcome

Dorsomedial Prefrontal Cortex

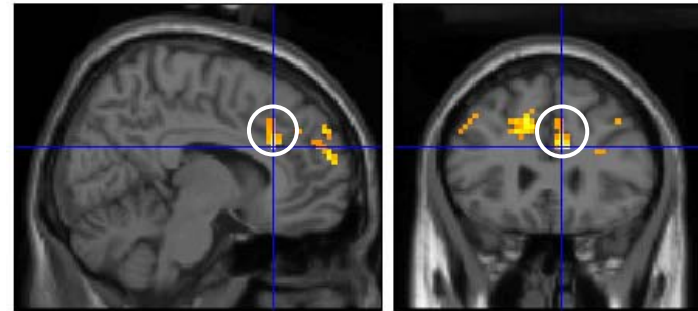


BA 6/9(-12,30, 36), $Z = 4.07$

BA 9(18, 54, 30), $Z = 4.00$

Little bit of vmPFC too

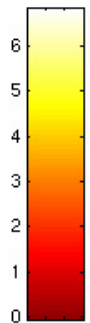
Anterior Cingulate & vmPFC

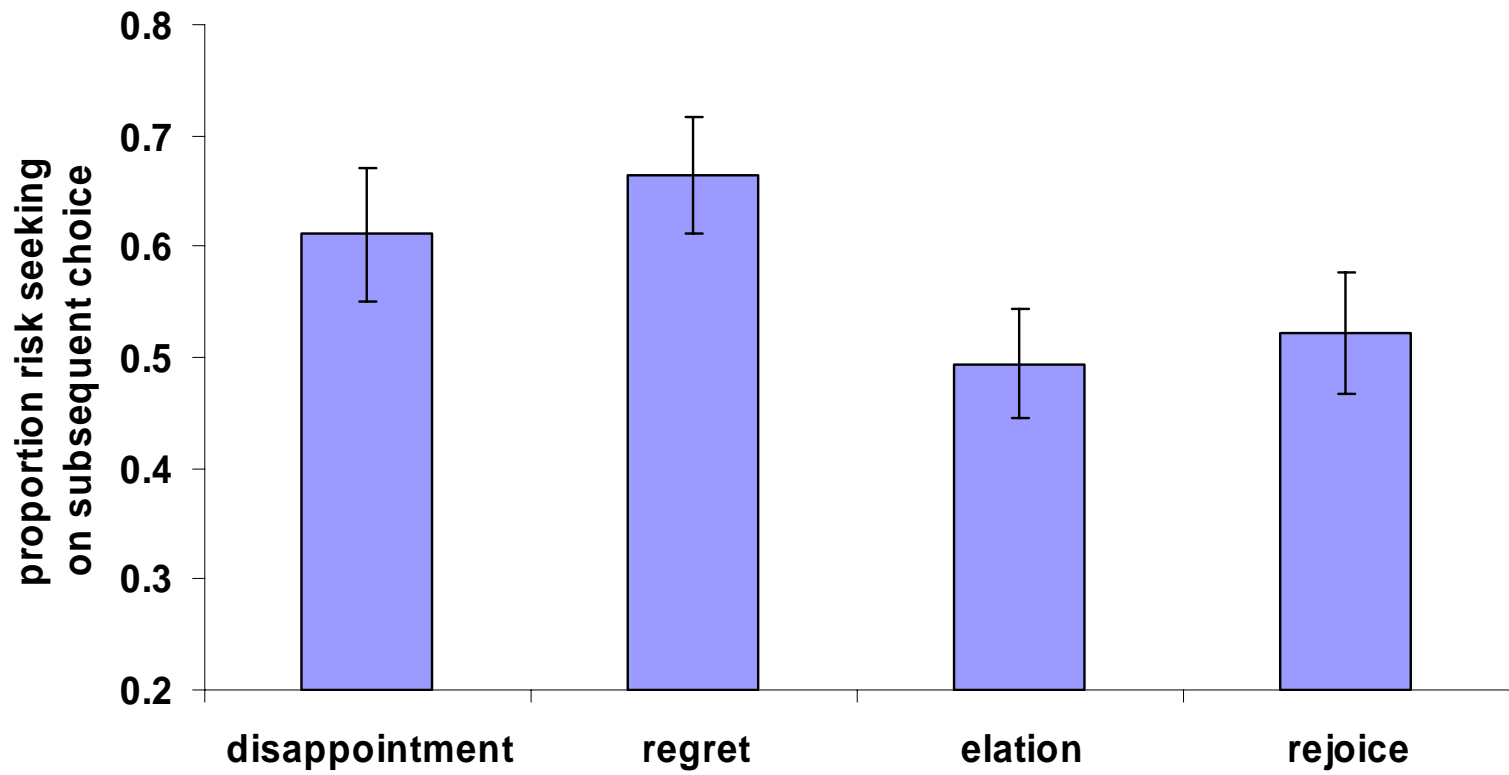


L

R

BA 32 (9, 27, 24), $Z = 3.90$





Summary so far

- Regret is subjectively worse than disappointment
- Trend for regret to lead to more risk seeking choices
- There are both overlapping and differential neural activations associated with regret and disappointment.
- Differential neural activations offer converging evidence with the behavioral findings.
- Regret seems to invoke compensatory behavior, which could involve reappraisal and reversal learning/response inhibitory processes.