An Attention-Based Approach to Understanding the Influence of Induced Affective States on Risky Decision-making

Rui Gong and James E. Corder
Teachers College, Columbia University, New York, NY.

Abstract
We investigated whether induced affective states (negative or neutral) can affect the process and outcomes of decisions under risk. Participants responded to 16 decision problems, each offering a pair of decision options: 1) sure gain vs. mixed-domain risky or 2) sure loss vs. mixed-domain risky. By eye-tracking based attentional measures in the context of mixed-domain decisions, we can track decision-makers’ attention to both positive (gain) and negative (loss) information during decision-making. This also enables investigation of whether mood affects the use of heuristic versus analytic strategies.

Mood Congruence or Mood Maintenance?
Mood Congruence: affective states may influence decision-making because the decision maker selectively attends to emotion-relevant information, pushing their decision outcomes in a mood-congruent direction (Niedenthal & Setterlund, 1994).
- Affect Infusion Model (AIM)
  Positive mood -> attention to positive information -> risk-seeking
  Negative mood -> attention to negative information -> risk-averse

Mood Maintenance: affective states motivate behavior such that individuals act to maintain or attain positive mood states (Kliger & Kudryavtsev, 2014).
- Mood-Maintenance Hypothesis (MMH)
  Positive mood -> motivation to maintain the mood -> risk-averse
  Negative mood -> motivation to relieve the mood -> risk-seeking

Heuristic vs. Systematic Strategy?
- It has also been suggested that individuals who are in a positive mood are more likely to adopt a heuristic processing strategy, a tendency to use intuition and “gut feelings” with relatively little attention being paid to details. In contrast, individuals who are in a negative mood are more likely to adopt a systematic processing strategy, with careful analysis of information (George & Dane, 2016; Schwarz, 2000).

Goals of the Present Study:
- To examine the contrasting predictions of AIM and MMH, and to further investigate use of heuristic and analytic strategies, we used eye-tracking based attentional measures to investigate individuals’ allocation of attention to relevant problem information (gain vs. loss, value vs. probability) in a study of sure-thing outcomes paired with mixed-domain options in decisions under risk.

Methodology
Study Procedure:
1. Calibration
   - A procedure with the eye-tracker to enable accurate gaze point calculations.
2. Mood Induction Task
   - News-story reading: Participant reads one story categorized as either “sad” or “neutral” (both from The New York Times).
3. Self-reported Mood Questionnaire (before and after the DM task)
   - Participants rate on a 7-point Likert scale how well each of the following terms (angry, depressed, sad, neutral, interested, bored, irritable, annoyed, calm, discouraged, relaxed) describe how they feel at that moment.
4. Decision-making Task
   - Participants make a choice on 16 mixed-domain decision problems (randomized and counterbalanced), that varied in problem structure: offering a choice between either: a sure gain vs. a mixed risky option (PS1), or a sure loss vs. a mixed risky option (PS2).

Findings
- The mood inductions were effective, as judged by manipulation checks comparing self-reported mood measures for the two mood conditions: F(2, 35) = 21.143, p < .001 (1st Mood Check – Before DM task)
  F(2, 35) = 3.495, p = .037 (2nd mood check – After DM task)

- CHOICE: A mixed-model ANOVAs of participants’ choice behavior showed no effect of mood condition on the probability of EV-consistent choices. However, participants’ choices were found to be significantly affected by problem structure (F(1, 56) = 9.846, p = .003): Participants had more EV-maximizing choices for PS2 (sure loss - mixed problems) than for PS1 (sure gain - mixed problems).

- FIXATION DURATION: Participants in both mood conditions paid more attention to values than to probabilities. F(1, 56) = 25.785, p < .001.

- Although there was no overall difference in mean total fixation time between the mood conditions in the ANOVA, results from a sign test suggested that sad-mood participants consistently had shorter fixation times than did neutral-mood participants for both PS1 (sure gain - mixed) and PS2 (sure loss - mixed) problems (p = .013).

- A significant three-way interaction among Domain (gain vs. loss), Mood Condition, and Problem Structure was found, F(1, 56) = 6.415, p = .035.

- Participants spent more time inspecting the risky-option information for sure loss - mixed problems than for sure gain-mixed problems, and in those sure loss - mixed problems, participants tended to focus longer on loss information (compared to gain information) for the risky mixed options.

Discussion
These results are at variance with prior claims in the literature that individuals in a sad mood are more likely to adopt a systematic processing strategy, with careful analysis of information. In terms of choices, we found no difference in the rate of EV-maximizing between mood conditions. Our attention data shows that individuals in a sad mood had shorter total fixation time and a more uniform pattern of attention allocation. We interpret this pattern as indicating that sad-mood participants used a less analytic approach, perhaps as a way to reduce cognitive load. In contrast, participants in a neutral mood did a better job of focusing on critical problem information (potential losses versus gains), thus they could be described as being more analytic.

Findings (cont.)
- This Domain by Problem Structure interaction was especially pronounced for neutral-mood participants (Figure 1): sad-mood participants tended to spend less time overall, and allocate their attention more equally to relevant problem information.

Figure 1. The Three-way Interaction Among Condition, Domain and Problem Structure

Contact
Rui Gong, rg2796@tc.columbia.edu

Reference