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Rumination: Deductions on Inductions

Rumination is a well established cognitive vulnerability to depressed mood. Research exploring the causal relationship between rumination and depressed mood has used an induction method limited by its design and the definition it is based on. The current project developed new rumination inductions and compared these with mood inductions (positive, negative and neutral) and the traditional rumination and distraction inductions. The three novel inductions were based on the mood inductions, but presented three phrases repeatedly instead of 24 sequential statements, mimicking the repetitive, recurrent nature of ruminative thought. Three hundred and eighty four student participants were randomly assigned to the 8 induction conditions. They then completed a mood measure and two cognitive tests assessing attention and inhibition. Results showed the two negative inductions and the two positive inductions produced poorer performance on the inhibition task, suggesting that mood may be more involved in impairments of inhibition than cognitive processes. There was also a significant difference in attention between the two neutral tasks suggesting that simply watching repeated phrases, as opposed to sequential phrases may impair attention. Implications for clinical practice are discussed.

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The proliferation of research examining rumination in the past decade highlights the complexity of this construct. Despite several years of exploration, much is still not understood about rumination and its relationship to other psychological variables. Evident in this body of literature is the variety of conceptualisations of rumination. Rumination can be seen as a coping response [1], as a form of self-focus [2] or as a general cognitive style [3]. These different conceptions are not necessarily in conflict, they simply reflect different perspectives. For example, examining rumination as a coping style might focus on the motivations behind the behaviour, or the individual's beliefs about the behaviour. In this sense, different conceptualizations of rumination simply reflect different questions about the behaviour. Across each of these perspectives, some agreement can be found. Rumination is significantly related to increased negative mood and depressive symptoms [4]. It is related to other behavioural variables such as impaired problem solving [5] and impaired interpersonal interactions [6]. Rumination is also related to other cognitive processes such as cognitive inflexibility [7], poorer working memory and other cognitive deficits [8].

Very well evidenced is that rumination is related to a great many things. Where this literature is unfortunately limited is in its ability to establish causal relationships. To demonstrate causation, one must go beyond showing a relationship exists and further determine temporal precedence and eliminate alternative explanations for the relationship. This is most effectively accomplished through experimental design, where one variable is manipulated and changes in other variables are assessed [9]. Existing experimental research in rumination has employed rumination induction procedures combined with negative mood, either pre-existing depressive symptoms, or laboratory induced [10,11]. Variations on this method exist, but continue to focus on content of thoughts in relation to something specific such as disturbing images [12] or personal recollection of a negative event [13].

Since its development in 1990 [11], this methodology has been used to explore a number of psychological, interpersonal and cognitive variables. Induced rumination has been used to explore the effect of rumination on anxiety [14] and negative mood [15,16]. It has also been used to investigate the effects of rumination on sleep [17]. This procedure has also been used to compare rumination and distraction to other ways of responding to negative mood such as mindfulness [18], and with interpersonal skills like social problem solving [19]. Finally, this induction procedure has been used to demonstrate a causal relationship between rumination and cognitive variables such as overgeneral autobiographical memories [20], negative thinking [21], impaired concentration [22], and failures of executive function [23].

While this induction method has produced an informative body of results, there are some limitations. It is based on Nolen-Hoeksema's definition of rumination as "a mode of *responding to distress* that involves repetitively and passively *focusing on symptoms of distress* and on the possible causes and consequences of *these symptoms*" [4]. This definition clearly sees rumination as a response to an already existing negative mood. This limits the ability to explore rumination as a vulnerability for the experience of negative mood in the first place. Despite the claim that this conception is about "the process of thinking perseveratively about one's feelings and problems rather than in terms of the specific content of thoughts", it very clearly focuses on thoughts about feelings of distress and the problems causing them. This again limits the scope of research into the phenomena [24].

The rumination induction based on this definition is further limited in its failure to capture a key characteristic of rumination – the repetitive, perseverative nature of rumination. Participants in this induction condition work their way consecutively through a series of statements [11]. Ironically, this sequential progression through the statements is quite possibly preventing rumination more than inducing it. Indeed, inspection of the induction and the items (e.g. think about your mood) may simply be increasing salience and awareness, and not actually simulating naturally occurring rumination.

Rumination can also be conceptualised more broadly as repetitive, recurrent, intrusive and uncontrollable thinking, regardless of content

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or valence [3]. Research employing a measure based on this definition shows this ruminative style of thinking is also still related to increased negative mood and predicts future depressed mood, despite the removal of valanced content from the questionnaire. Unfortunately, this definition is also not easily simulated because it is paradoxical to make someone think uncontrollably. However it may be possible to capture the repetitive and recurrent nature of rumination, which is part of both definitions.

This project is an initial exploration of inducing the repetitive and recurrent characteristics of rumination. Typical mood inductions, traditional rumination and distraction inductions as well as new novel rumination inductions will be compared on changes in mood and cognitive processing – in particular attention and inhibition. Recent research has demonstrated the relationship between executive functions and both depression and rumination [23,25]. Given the apparent similarities between perseveration and rumination, this is not surprising raising the question as to whether perseverative behaviours are an individual difference that predispose some people to more prolonged and severe depressed mood when faced with negative events and moods. Alternatively, does rumination impede executive functions that would otherwise allow an individual to redirect their attention away from their own negative mood to more positive content? Unfortunately, up to now it has been very difficult to parcel out the variance accounted for by depression and rumination as they so frequently co-occur. By comparing a variety of inductions it may be possible to get a clearer picture of the variance unique to each. Further, it will allow for an exploration of at least one of the questions above and provide some insight into the direction of causation. The main hypothesis is that inductions mimicking the repetitive, recurrent feature of rumination will produce more errors in attention and inhibition than those that do not. Further, inductions that increase negative mood will produce more errors of attention and inhibition than those that do not.

Method

Participants

Three hundred and eighty four first-year psychology students were recruited to participate in exchange for course credit. Data was screened for missing values. Due to computer error, data from 8 participants was blank, and thus had to be removed. Data from a further 10 participants showed considerable missing data, leaving a total sample of 366. Ages ranged from 17 to 62 with a mean of 22.62 (SD = 6.94). Sixty per cent of the sample was female.

Materials

Positive and Negative Affect Scale (PANAS; [26]): The PANAS is a measure of positive and negative affect and was used as a baseline measure of mood to demonstrate group equivalency. Respondents are asked to rate the degree to which they have experienced each emotion for a certain period of time. For the current study, participants were asked to base their ratings on the past 24 hours.

Reliability of the scale is good, and the cronbach's alpha for the current study are $\alpha = 0.88$ for both the PANAS positive and the PANAS negative.

Continuous Performance Task (CPT): Participants completed a computer task involving attending to a series of letters presented on the screen and responding by pressing the space bar whenever an 'X' was presented. Letters were presented in nine blocks of 20 letters, five of which were 'X's in each block. All letters were displayed for 250 ms each. The inter-stimulus intervals were 1, 2 and 4 seconds (fast, medium and slow speeds, respectively). Participants viewed three blocks for each of the speeds. Participants were also given a 'practice round' before commencing the task. The task took approximately eight minutes to complete, and produced two outcome measures for each of the speeds: number of correct hits as a measure of attention and number of false hits as a measure of impaired inhibition.

Simon task: This task is based on a modified Stroop Task designed by Hajcak, McDonald & Simons [27]. Much like the Stroop task, the Simon task requires participants to inhibit a dominant response. The computer screen presents a stream of red or green arrows, oriented left, right or towards the top of the screen. Each arrow was presented on the side of the screen congruent with the orientation of the arrow (for example, if an arrow was pointing right it was also presented on the right of the screen). Participants were instructed to respond to the colour of the arrow by pressing the "j" key for green, and the "f" key for red. Accuracy requires inhibiting an automatic response to the direction of the arrow if this is incongruent with the appropriate colour key. Thus, incongruent trials are expected to incur the greatest level of errors (i.e. pressing the j key for green, even though the arrow is pointing left; [27]). The variable of interest for this study is number of correct responses in the incongruent trials.

Visual Analogue Scale (VAS): Participants rated their mood by marking on a 100 mm line anchored by a smiley face at one end and a frowny face at the other. The advantage of using visual analogue scales for measuring mood is the absence of a graded scale, reducing the likelihood that participants will base their current mood on previous ratings. This helps to reduce demand characteristics when using mood inductions.

Experimental inductions

Mood inductions: Participants in these conditions viewed a series of 24 consecutive Velten statements [28] presented one at a time on a computer screen while listening to valence congruent music [29]. For the negative mood induction, participants listened to extracts of `Russia under the Mongolian Yoke', from Prokofiev's music for the film 'Alexander Nevsky', Adagio for Strings by Barber and organ in G minor by Albinoni [30], remastered at half speed. Sample negative Velten statements include "I'm completely alone" and "I feel worthless". Participants in the positive group listened to Peer Gynt by Grieg and The Moldau by Smetna and read positive statements such as "I can make things happen" and "my parents brag about me to their friends". Finally, subjects in the neutral condition listened to extracts from Chopin Waltz No. 12 in F minor, Op. 70, No. 2 and Chopin Waltz No. 11 in G flat major, Op. 70 No. 1. Neutral Velten statements were largely factual, for example "the desert climate is hot and dry".

Traditional rumination and distraction conditions [11]: For both the rumination and distraction condition, participants are asked to spend a few minutes considering statements presented in a full list on the screen. They are asked to use their imagination and to concentrate on each of the ideas. Example items from the rumination condition include, "trying to understand your feelings", "how awake/tired you feel now", and "the amount of tension in your muscles". Example items from the distraction condition include, "the layout of a typical classroom", "the shape of a large black umbrella", and

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"the movement of an electric fan on a warm day". These inductions, in the absence of existing negative mood are not analogous to their use in many previous studies, however it is of interest to explore the potential effect of simple self-focused attention on cognitive processes. It may well be that these inductions produce changes in the absence of negative mood, but they have not been compared to other inductions in this way.

Novel rumination inductions: These inductions were created in an attempt to mimic the repetitive and recurrent nature of ruminative thoughts. Three statements were selected from each of the mood inductions at random (random computer selection). Instead of participants seeing 24 statements consecutively, they would see these three statements presented one at a time, repeatedly. These 3 statements are shown 6 times each with the entire induction lasting the same length of time as the mood inductions. The three statements for the novel negative rumination condition were, "Why should I try when I can't make a difference anyway", "What's the point of trying?", and "Sometimes I feel so guilty that I can't sleep". The three statements for the novel positive rumination induction were, "The world is full of opportunity and I'm trying to take advantage of it", "I know I can do it; I'm going to seize the day!", and "I can make things happen". The statements for the novel neutral rumination induction were, "Apples are harvested in the Fall", "Basket weaving was invented before pottery making", and "Arizona has both deserts and pine-covered mountains". The music was kept the same as in the mood inductions.

Mood repair: To ameliorate any lingering negative effects of the negative mood induction, the traditional rumination induction or the novel negative rumination induction, all participants took part in a mood repair. After completing all of the research tasks, participants listened to a 2-minute audio clip of a stand-up comedy routine, and then rated their mood a final time.

Procedure

Participants were tested in groups of 6 or less in a computer lab. Because negative mood would be induced in some of the participants, the information sheet was very clear about what that would involve and all participants were assured that they could withdraw at any time without penalty. The computer randomly assigned participants to the different conditions. Participants began by completing the Positive and Negative Affect Scale and the first Visual Analogue scale (VAS1). They then completed the induction that they were assigned to, and rated their mood a second time (VAS2). They then completed the CPT and the third measure of their mood (VAS3) and then the Simon task and the fourth measure of their mood (VAS4). Finally, they listened to the mood repair clip and rated their mood a final time (VAS5). Participants were debriefed and provided with contact information if they had any questions in the future.

Results

A p value threshold of 0.05 was set for all analyses. A one-way ANOVA was completed to ensure the groups were equal on negative affect prior to the inductions, and no significant differences were found ($F(1,366) = 1.25$, n.s.). There were also no significant differences between groups on baseline positive affect ($F(1,366) = 0.04$, n.s.).

Changes in Mood across time are illustrated in Figure 1. Following the inductions, there is a significant change in mood, with the two negative induction groups producing significantly increased negative mood (negative mood $F(1,47) = 38.79$, $p = 0.00$; novel negative $F(1,47) = 11.95$, $p = 0.00$). The two positive conditions produced significantly reduced negative mood (positive mood $F(1,45) = 56.02$, $p = 0.00$; novel positive $F(1,45) = 94.14$, $p = 0.00$). The traditional rumination induction produced significantly greater depressed mood ($F(1,45) = 6.43$, $p = 0.01$) and the traditional distraction produced no significant change in mood ($F(1,45) = 0.14$, n.s.). Interestingly, the two neutral groups both significantly reduced negative mood (neutral mood, $F(1, 45) = 9.24$, $p = 0.01$; novel neutral $F(1,45) = 5.17$, $p = 0.03$.

Figure 2 shows the two negative groups are not significantly different from each other ($t(94) = 0.83$, n.s.), nor are the two positive ($t(90) = 1.47$, n.s.), or the two neutral ($t(86) = -0.13$, n.s.). Further, the traditional rumination and traditional distraction groups did significantly different from each other ($t(90) = 2.00$, $p = 0.05$).

Simon task: For the sample as a whole, correct scores on congruent trials and correct scores on incongruent trials were compared. As expected, all participants had fewer correct scores for incongruent trials (M = 21.65, SD = 4.14) than congruent trials (M = 22.58, SD = 3.82; $t(375) = 10.39$, p = 0.00). A one way ANOVA across induction groups showed significant between group differences ($F(7, 359) = 2.65$, $p = 0.01$). Figure 3 illustrates the group means. Post hoc analyses showed the only significant group differences were between the negative mood induction (M = 19.96, SD = 6.48) and the neutral mood induction (M = 22.57, SD = 1.52, $p = 0.04$) and the novel neutral induction (M = 22.90, SD = 1.17, $p = 0.01$, with the negative mood induction group showing the fewest correct responses and the two neutral induction groups showing the greatest number of correct responses. While not all of the group differences

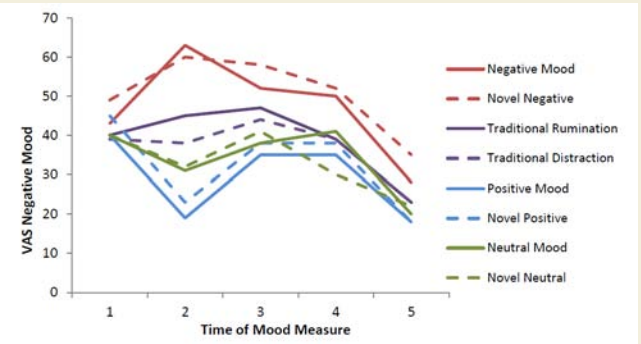

Figure 1: Changes in mood over time by group.

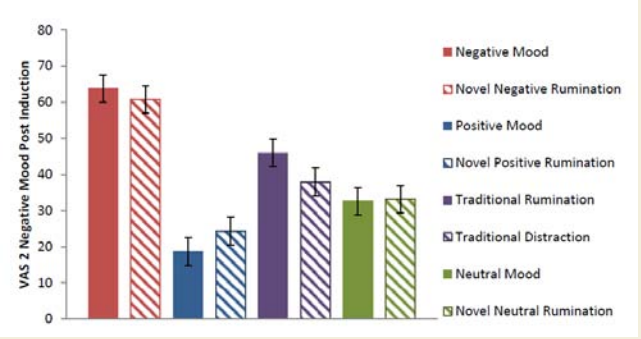

Figure 2: Post induction mood by group.

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are statistically significant, the pattern of scores is interesting. The mood related inductions, both positive and negative, showed the poorest performance, while the inductions not expected to change mood showed the best performance. The pattern of results suggests differences may be more related to mood than rumination.

CPT: One-way ANOVA analyses examined group differences on CPT performance. There were no significant group differences for false hits, however, there was a significant difference for the correct hits. Unlike the Simon Task, the differences in attention appear to be related to the repetitive, recurrent features of rumination more than mood. As illustrated in Figure 4, the two negative inductions did not differ, nor did the two positive or the two traditional. However there was a significant difference between the neutral Mood induction (M = 31.70, SD = 2.93) and the novel neutral rumination induction (M = 25.3, SD = 9.05, $p = 0.00$)

Discussion

This is a very preliminary examination of a new way to simulate ruminative thinking for experimental studies. Previous inductions have relied upon existing or induced negative mood prior to inducing rumination, making it difficult to clearly separate the role of ruminative thinking from that of negative mood. This project focused on the repetitive, recurrent characteristics of ruminative thinking, while controlling for negative, positive or neutral content, to separate cognitive process from mood. Given the shared features with rumination and perseveration, and previous research showing links between both mood, rumination and executive function, cognitive processes related to executive function – attention and inhibition – were explored as outcome variables.

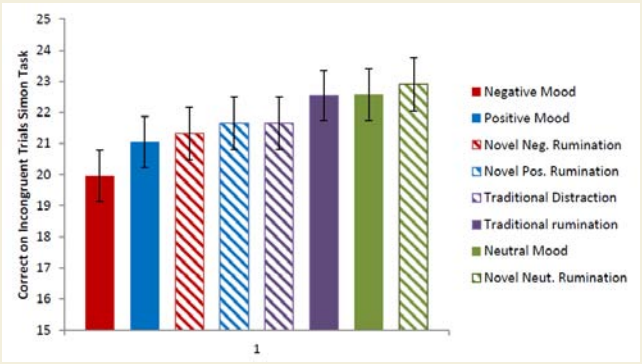

Figure 3: Correct responses incongruent trials on Simon Task by group.

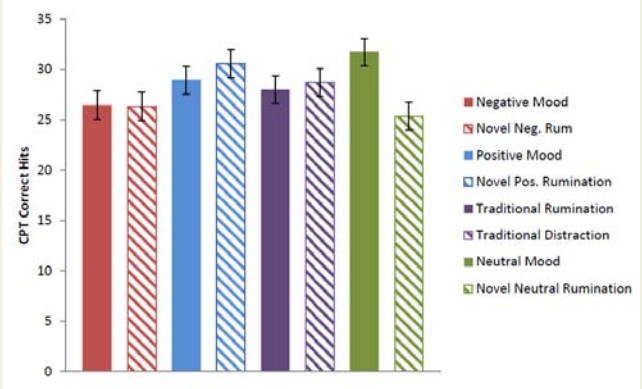

Figure 4: Correct hits on Continuous Performance Task by group.

Negative mood changed in the direction expected for each of the inductions. Despite the lack of induced negative mood, the traditional rumination induction produced an increase in negative mood. This is consistent with research showing that simple self-focused attention can worsen mood [2]. As expected, the traditional distraction induction produced no significant changes in mood. While the neutral mood induction and the novel neutral rumination induction both reduced negative mood, they were not significantly different from each other. The two negative groups produced increases in negative mood and the two positive groups produced decreases in negative mood. The two negative groups did not significantly differ, nor did the two positive groups significantly differ.

Group differences on false hits on the CPT were not significant however there were significant group differences for correct hits. Of interest was the significant difference between the two neutral groups. These two inductions produced no significant changes in negative mood, but the novel rumination condition appears to have produced significant reductions in attention. It appears that even with no change in mood, reading a series of repeating statements is having an effect on cognitive processes. This repetitive, recurrent presentation of stimuli may be mimicking perseverative behaviours seen in failures of executive function, which is also related to attention [31]. Previous research exploring rumination and executive function has found that a broader measure of rumination focusing on the characteristic features of repetitive, recurrent, intrusive and uncontrollable thinking was specifically related to failures in attention, while mood was more closely linked to failures in inhibition [24].

For the Simon task, a measure of inhibition, the current results may support this as it appears that mood plays a greater role than ruminative processes, with participants in the conditions that change mood, both positive and negative, showing the poorest performance. It must be emphasized that mood did not show statistically significant differences, but these findings are in line with previous findings [24]. Separating inhibition from attention may be as impossible as separating ruminative thought from negative mood, but if we consider that they are discrete entities, the addition of negative mood to a ruminative thought style would create an even more entrenched process. The added impairment in the ability to inhibit ruminative thoughts incurred with the depressive mood would make the cycle that much harder to break. Further, links between positive mood and impairments in executive function have been made [32] and similarly show a tendency toward impairments in inhibition [33]. Explanations offered are differences in neurochemistry, motivation or diffuse semantic activation. Regardless of the mechanisms involved, it has been concluded that even mild variations in mood, both positive and negative, may have an impact on executive functions.

For treatment considerations, we must bear in mind that if mood and rumination can exist in isolation from each other, amelioration of depressed mood and depressive symptoms does not necessarily mean that a person's tendency toward ruminative thinking has also been successfully treated. This lingering cognitive process may well be the vulnerability that explains depressive relapses that so frequently occur.

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References

1. Nolen-Hoeksema S (1991) Responses to depression and their effects on the duration of depressive episodes. J Abnorm Psychol 100: 569-582.
2. Mor N, Winquist J (2002) Self-focused attention and negative affect: a meta-analysis. Psychol Bull 128: 638-662.
3. Brinker JK, Dozois DJ (2009) Ruminative thought style and depressed mood. J Clin Psychol 65: 1-19.
4. Nolen-Hoeksema S, Wisco BE, Lyubomirsky S (2008) Rethinking rumination. Perspect Psychol Sci 3: 400-424.
5. Lyubomirsky S, Nolen-Hoeksema S (1995) Effects of self focused rumination on negative thinking and problem solving. J Pers Soc Psychol 69: 176-190.
6. Watkins E, Baracaia S (2002) Rumination and social problem-solving in depression. Behav Res Ther 40: 1179-1189.
7. Davis RN, Nolen-Hoeksema S (2008) Cognitive inflexibility among ruminators and nonruminators. Cognitive Therapy and Research 24: 699-711.
8. Joorman J, Gotlib IH (2008) Updating the contents of working memory in depression: interference from irrelevant negative material. J Abnorm Psychol 117: 182-192.
9. Spencer SJ, Zanna MP, Fong GT (2005) Establishing a causal chain: Why experiments are often more effective than mediational analyses in examining psychological processes. J Pers Soc Psychol 89: 854-851.
10. Lyubomirsky S, Caldwell ND, Nolen-Hoeksema S (1998) Effects of ruminating and distracting responses to depressed mood on retrieval of autobiographical memories. J Pers Soc Psychol 75: 166-177.
11. Morrow J, Nolen-Hoeksema S (1990) Effects of responses to depression on the remediation of depressive affect. J Pers Soc Psychol 58: 519-527.
12. Zetsche U, Ehring T, Ehlers A (2009) The effects of rumination on mood and intrusive memories after exposure to traumatic material: An experimental study. J Behav Ther Exp Psychiatry 40: 499-514.
13. Ehring T, Fuchs N, Klasener I (2009) The effects of experimentally induced rumination versus distraction on analogue posttraumatic stress symptoms. Behav Ther 40: 403-413.
14. Blagden JC, Craske MG (1996) Effects of active and passive rumination and distraction: A pilot replication with anxious mood. J Anxiety Disord 10: 243-252.
15. Singer AR, Dobson KS (2007) An experimental investigation of the cognitive vulnerability to depression. Behav Res Ther 45: 563-575.
16. Lyubomirsky S, Nolen-Hoeksema S (1993) Self-perpetuating properties of dysphoric rumination. J Pers Soc Psychol 65: 339-349.
17. Guastella AJ, Moulds ML (2007) The impact of rumination on sleep quality following a stressful event. Personality and Individual Differences 42: 1151-1162.
18. Huffziger S, Kuehner C (2009) Rumination, distraction, and mindful self-focus in depressed patients. Behav Res Ther 47: 224-230.
19. Donaldson C, Lam D (2004) Rumination, mood and social problem-solving in major depression. Psychol Med 34: 1309-1318.
20. Park RJ, Goodyer IM, Teasdale JD (2004) Effects of induced rumination and distraction on mood and overgeneral autobiographical memory in adolescent major depression and controls. J Child Psychol Psychiatry 45: 996-1006.
21. Lyubomirsky S, Nolen-Hoeksema S (1995) Effects of self-focused rumination on negative thinking and interpersonal problem solving. J Pers Soc Psychol 69: 176-190.
22. Lyubomirsky S, Kasri F, Zhem K (2003) Dysphoric rumination impairs concentration on academic tasks. Cognitive Therapy and Research 27: 309-330.
23. Watkins E, Brown RG (2002) Rumination and executive function in depression: an experimental study. J Neurol Neurosurg Psychiatry 72: 400-402.
24. Brinker JK, Gibbs L, Campisi M, Izzard R (2013) Rumination, mood and cognitive performance. Psychology 4: 224-231.
25. Whitmer AJ, Banich MT (2007) Inhibition versus switching deficits in different forms of rumination. Psychol Sci 18: 546-553.
26. Watson D, Clark LA (1994) The PANAS-X: Manual for the Positive and Negative Affect Schedule- Expanded Form. University of Iowa, Iowa City.
27. Hajcak G, McDonald N, Simons RF (2003) To err is autonomic: error-related brain potentials, ANS activity, and post-error compensatory behavior. Psychophysiology 40: 895-903.
28. Velten E Jr (1968) A laboratory task for induction of mood states. Behav Res Ther 6: 473-482.
29. Clark DM, Teasdale JD (1985) Constraints on the effects of mood on memory. J Pers Soc Psychol 48: 1595-1608.
30. Clark DM (1983) On the induction of depressed mood in the laboratory: Evaluation and comparison of the Velton and musical procedures. Advances in Behaviour Research and Therapy 5: 27-49.
31. Alvarez JA, Emory E (2006) Executive function and the frontal lobes: a meta-analytic review. Neuropsychol Rev 16: 17-42.
32. Mitchel RL, Phillips LH (2007) The psychological, neurochemical and functional neuroanatomical mediators of the effects of positive and negative mood on executive functions. Neuropsychologia 45: 617-629.
33. Phillips LH, Bull R, Adams E, Fraser L (2002) Positive mood and executive function: evidence from stroop and fluency tasks. Emotion 2: 12-22.