Sad and fearful face distractors do not consume working memory resources in depressed adults

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Background

* Visual working memory (VWM) is a fundamental cognitive system that maintains and manipulates visual information from the outside world in a short period. Contralateral delay activity (CDA) components can index the number of objects maintained by VWM (Vogel & Machizawa, 2004).

* Filtering provides an effective mechanism to select only relevant visual information and to prevent irrelevant information storing into VWM (Vogel, McCollough, & Machizawa, 2005). Our group has used CDA to investigate the filtering of emotional face distractors (Ye et al., 2018).

* A bias for negative information is central to cognitive theories of depression (Beck 1976). Patients with depression have shown selective attention to sad but not angry or happy faces (Gotlib et al., 2004).

Research question

- By measuring the CDA indicative of filtering, we found that the control group failed in filtering fearful face distractors. In contrast, the depressed group successfully filtered both sad and fearful distractors.

- The results indicate that healthy individuals are difficult to filter fearful distractors during the VWM task. However, sad and fearful face distractors do not automatically consume working memory resources in depressed group. That is, depressed individuals can avoid consolidating negative emotional faces into their VWM when the faces are task-irrelevant.

- The efficient filtering of faces with negative emotions in depressed individuals can be related to the automatic emotion regulation strategy that is beneficial in depression.

Conclusion

Sample

Participants with elevated amount of depression symptoms (n = 18; Beck’s Depression Index-II scores > 14) and control (n = 18; BDI-II < 5).

Design

In order to estimate filtering efficiency, as Figure 1, we applied a lateralized change detection task (non-distractor condition) and two filter tasks (fearful-distractor condition and sad-distractor condition). Participants need to memorize the two colors in the cue handheld and ignore the face distractors when the memory array display, and indicated whether there was a change in the color or not when the test array display.

ERP Recording and Analyses

P7, P8, PO7, PO8 were chosen for analysis. CDA were analyzed from the area marked with the rectangle which was defined by subtracting the ipsilateral activity from the contralateral activity, with a measurement window of 500–1000 ms after the onset of the memory array. Repeated measure ANOVAs with conditions (non-ds vs. fearful-ds vs. sad-ds) and participants group (depressed vs. control) was conducted for the behavioral accuracy and CDA amplitude.

Figure 1. Example for change detection task (top row: non-distractor condition) and filter tasks (middle row: fearful-distractor condition; bottom row: sad-distractor condition).

Figure 2. The accuracy results (blue: non-distractor condition; red: fearful-distractor condition; gray: sad-distractor condition). Mean accuracy values and their error bars show the 95% confidence interval of mean. The planned comparisons showed a higher accuracy for the depressed group in the non-distractor condition than in the fearful distractor condition, but no significant difference in accuracy was found between the non-distractor condition and the sad distractor condition, or between the fearful distractor condition and the sad distractor condition. For the control group, the accuracy was higher in the non-distractor condition than in the fearful distractor condition, or in the sad distractor condition, but no significant difference in accuracy was found between the fearful distractor condition and sad distractor condition, NS = p > .05; * = p < .05; ** = p < .01.

Figure 3. Grand-averaged ERP waveforms time-locked to the onset of the memory array in different conditions for the depressed group (left) and control (right) group. Grey areas indicate the time windows used to calculate the mean amplitude values for the CDA.

Figure 4. The results of the CDA amplitude for the depressed (left) and control (right) groups in non-distractor, fearful-distractor and sad-distractor condition separately. Mean amplitude values and their error bars show the 95% confidence interval of mean. The ANOVA showed a significant main effect of condition, and a significant interaction effect of condition by group, but no significant main effect of participant group. As Figure 4, Follow-up pairwise comparison showed that, in the depressed group, there was no significant difference in CDA amplitude between the non-distractor, fearful-distractor and sad-distractor conditions. In the control group, CDA amplitude in fearful-distractor conditions was significantly larger than those in non-distractor condition. However, significant difference in CDA amplitude was found neither between the fearful-distractor and sad-distractor condition, nor between the non-distractor condition and sad-distractor condition. NS = p > .05; ** = p < .01.

Reference


McCollough, & Machizawa, 2005) Filtering provides an effective mechanism to select only relevant visual information and to prevent irrelevant information storing into VWM (Vogel, McCollough, & Machizawa, 2005). Our group has used CDA to investigate the filtering of emotional face distractors (Ye et al., 2018).


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