

Valance Bias in Fidelity of Visual Working Memory for Emotional Faces

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Introduction

Working memory (WM) refers to the cognitive ability to temporally maintain and flexibly control sensory information. Although previous studies have shown that the valence of emotion influences WM performance, when (the encoding or maintaining stage) and how emotional faces affect the different aspects of WM (representational precision or capacity) remain largely unknown. Here, the current study adopted a modified continuous report paradigm with morphing faces (happy, neutral, or fearful faces) to investigate working memory precision and capacity for emotional faces. By utilizing emotional pre-cue and retro-cue, we tapped into the stages at which emotion exerts its influence on WM.

Methods

Materials

We selected faces of three different ethnicities as our anchor faces to lower the task difficulty. To create pseudocontinuous faces wheels, we linearly morphed 147 additional faces among three anchor faces for each emotional valence.

Procedure

In the experiment 1, after seeing one or two faces of the same emotion (happy, neutral, or fearful), 20 volunteers (mean age = 24.8 years) were asked to select the probed face on a pseudocontinuous face wheel. In experiment 2a (N = 20, mean age = 20.9 years) and experiment 2b (N = 21, mean age = 20.3 years), three faces were shown to participants simultaneously with a pre- or post- emotional cue (75% valid) given in the task.



cues(B) in Experiment 2a and 2b. The figure illustrates trials with valid cues for fearful faces.



Results

We calculated the response error and subjected the results to a standard mixture model (Zhang & Luck, 2008). The result of the experiment 1 indicated that participants showed higher precision for fearful faces

than happy faces when memory load was high. Moreover, this fearful bias modulated by emotional cues. Specifically, there was no difference in working memory precision and capacity across three types of emotional faces when cued by the pre-cue. Furthermore, valid pre-cue compared to invalid pre-cue improved memory capacity for all types of faces. In the retro-cue task, participants recalled fearful faces with the highest precision, followed by neutral faces, and happy faces with the lowest. Moreover, the beneficial cueing effect by retro-cues selectively improved WM precision (but not capacity) for fearful faces. In contrast, for happy and neutral faces, the cueing benefit was reflected in WM capacity.







Figure 4 The effect of cue validity and emotion on Pm and SD for the pre-cueing task (A and B, respectively) and retrocueing task (C and D, respectively). ** p < 0.01. *** p < 0.001.

Figure 5. The effect of emotion on Pm and SD difference between the valid and invalid conditions for the pre-cueing (A and B, respectively) and retro-cueing task (C and D, respectively). * p < 0.05.



Discussion and Conclusion

Taken together, these findings suggested that fearful faces were recalled with higher precision than both happy and neutral faces, especially under high load. Moreover, this fearful bias mainly appeared at the stage of WM encoding but not WM maintaining, because only the pre-cue rather than retro-cue could eliminate this bias. Finally, the cueing benefit for fearful faces was different from happy and neutral faces, that is, the former was associated with an enhancement for the fidelity of representation, while the latter two were related to the reduction of the internal noise in the memory system.