Abstract

Events under stress are in general better remembered, but the effect of stress specifically on detail and gist information of the events is still inconsistent among studies. What could explain the mixed findings together may be that the quality of memories changes over time. Declarative memory depends less on the hippocampus over time, and this region is regarded essential for detailed memory suggested by multiple studies on pattern separation. Taking into account that stress-induced noradrenaline increase can enhance synaptic plasticity in the hippocampus, we hypothesized that details might initially be better remembered if encoded under stress, and a stronger gist may remain over time. Correspondingly, we predicted that encoding neural activity in the hippocampus should reflect such modulation, specifically be able to better predict subsequent detailed memories encoded under stress.

The present study was designed to test the hypotheses in humans using event-related functional Magnetic Resonance Imaging. We investigated neural activity during memory formation in 49 healthy participants in an incidental encoding task containing embedded in either a neutral or stressful context. Subsequent recognition test containing identical targets, similar lures and novel foils, was performed after 24h and 1 week by asking participants to respond '*new*', '*similar*', or '*old*' per stimulus. Functional MRI and heart rate were acquired throughout procedures. Blood pressure and a set of questionnaires were obtained additionally at specific times.

Our data show that heart rate frequency and the negative-affect scores of PANAS were higher in the stress group compared to the neutral group, but we did not find group differences in blood pressure and heart rate variance. These together indicated a moderate effect of stress induction. We used recog index and patsep index, calculated from response proportions in the recognition test, to respectively represent gist and detailed memory. No difference of two indices were detected between the neutral and stress groups at both delays. As for the encoding neural activity, we did not find different hippocampal activation in target trials that were later remembered than in trials later forgotten, a contrast for gist memory subsequent memory effect (SME). Critically, there was no difference of hippocampal activation in response to lures that were later responded as '*similar*' than '*old*', defined as an SME representing pattern separation process. Stress, moreover, showed no effects on both SMEs in the hippocampus.

To conclude, during-encoding stress in this study did not show improvement for gist memory, or enhancing effect of detailed memory. Hippocampal activity is not predictive for the subsequent pattern separation, and is not further influenced by stress induction.