A role of amygdala in false memory of face in the short-term memory range

Introduction

False memory is a phenomenon in which accurate memory formation is disturbed and people mistake a new item as an old item in a laboratory testing. Numerous behavioral and neuroimaging studies have investigated memory distortion by inducing false memory for words, figures, and faces in episodic or long-term memory domains. However, recently, false memory effects have also been reported in the domain of short-term memory (STM) (1), (2). To date, a neuroimaging study has investigated the neural correlates of false memory in the STM using functional magnetic resonance imaging (fMRI) and has demonstrated a similar role of the amygdala in both short-and long-term memory processes (2). This study investigated the role of the amygdala in the STM and the correlation between the amygdala activity and false memory for face.

Methods

The participants were 19 right-handed healthy subjects (9 men, 10 women; mean age = 19.9 years, SD = 1.7 years) and had normal or corrected-to-normal vision. A set of morphed faces used in our previous study was used to create stimuli. The subject was instructed to memorize the memory set faces for 2.5 s. After the presentation of fixation for 1.5 s, a probe face was shown to the subject for 2 s (A). There were three conditions for probe face.

- **OLD**: the probe face was one of the faces in the memory set of the same trial.
- **LURE**: the probe face was a similar face with one of the memory set faces.
- **NEW**: the probe face was a novel face and never similar with the memory set faces.

The subject was instructed to make an old/new judgment as to whether the probe face was shown in the memory set of the same trial as accurately and quickly as possible.

- Functional images of the brain were obtained in an axial-oblique position by using a 3-T MRI scanner (Allegra, Siemens) equipped with single-shot echo planar imaging (TR = 2.3 s, TE = 30 ms, flip angle = 80°, 64 × 64 matrix, 36 slices, voxel size = 3 mm × 3 mm × 3 mm). The data were analyzed by SPM8 in an event-related manner.

Results

- There were significant differences in the proportion of old responses between the conditions (p < 0.01, B).
- The subject had significantly higher old response rates in the LURE condition than in the NEW condition, indicating an occurrence of false memory in the STM.
- The RT was fast for the correct responses and slow for the incorrect responses, and the LURE condition was in the midst of them (C).
- The results of ANCOVA with contrast images of old minus new responses showed that there was a significant negative correlation between the amygdala activity and mean of RT (F). The results indicate that, for the probe face, the shorter the RT, the higher the right amygdala activity.

Discussion and Conclusion

The present study showed that false memory for face occurred within the STM range and activity of the human amygdala was partially involved in such memory processes. The negative correlation between the amygdala activity and RT suggests a critical role of amygdala in detection of stimulus saliency. The present results indicate that the amygdala possesses a common role in both long- and short-term false memory of faces. We conclude that the amygdala is involved in detecting not only fear but also the saliency of items, and supports goal-oriented behavior by modulating perception, attention, and memory.

References and Notes

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