



Retrosplenial Contributions to Verbal Emotion Processing

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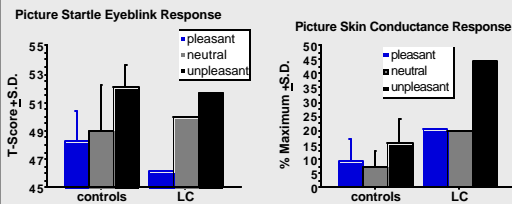


ABSTRACT

Background. Recent functional neuroimaging studies have suggested that the retrosplenial (RS) area may play an important role in evaluating emotional stimuli. Our previous research using emotional pictures in a patient with a left RS lesion did not support these findings. A reevaluation of the imaging literature revealed that left RS activations were found primarily in studies using verbal emotional stimuli. In this study, we test the hypothesis that emotion processing in the RS region is, at least partly, material-specific. **Methods.** We report follow-up data on a 48-year-old left-handed male following removal of an AVM in the left RS cortex. Experimental measures of emotion processing included psychophysiological reactivity (SCR, startle) to aversive, neutral, and pleasant words and sentences. Responses were compared to controls (N=5 for Word Triplets; N=12 for Sentences). **Results.** Physiologic reactivity to verbal emotional stimuli was markedly abnormal. While our patient showed normal arousal (SCR) to emotional words, fear-potentiated startle was significantly reduced to both types of verbal stimuli relative to controls. These findings contrast with his normal physiologic reactivity to emotional visual stimuli. **Conclusion.** Our study represents the first human lesion study to implicate the RS cortex in emotion. In particular, our results suggest that the left RS region may be part of a neural network essential for processing emotionally-salient verbal material. These findings corroborate imaging research suggesting that emotion processing within this region may be material-specific.

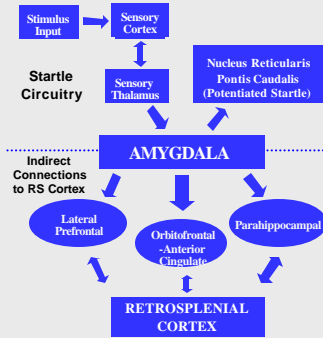
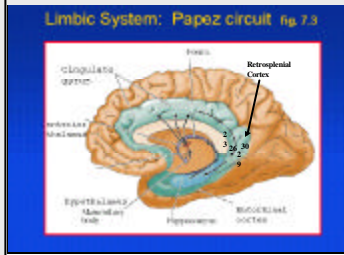
INTRODUCTION

Retrosplenial lesions in humans have been associated with profound amnesia (Bowers et al., 1987; McDonald et al., 2001; Valenstein et al., 1987). Recent neuroimaging studies have suggested that the RS area may also play a prominent role in processing of emotionally-salient information. In one review, the RS cortex (area 29, 30) was cited as the cortical area most consistently activated by emotionally salient stimuli across 25 studies (Maddock, 1999). Until recently, no case studies had examined emotional processing in patients with discrete retrosplenial lesions. We previously described a patient with a left RS lesion who was given a variety of emotion tasks, including psychophysiological measures. As shown below, this patient displayed normal reactivity (startle eyeblink, SCR, subjective ratings) to emotional pictures. These findings do NOT support a unique role for the left RS cortex in processing visual emotional materials.



Rationale & Hypothesis: Our patient had a discrete lesion of the left RS region. It remains possible that left RS lesions might induce deficits in reactivity to verbal emotional stimuli, due to hemispheric asymmetries in processing verbal/nonverbal stimuli. The purpose of the present study was to test the hypothesis that our patient had a material specific deficit in emotional processing for verbal materials. To test this hypothesis, we evaluated reactivity to emotionally salient verbal stimuli and compared them to findings with visual emotional materials.

METHODS



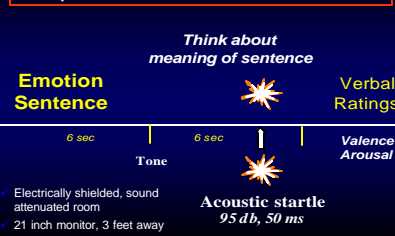
Case L.C.

- 48 year-old, left-handed college educated male
- **AVM in Left Retrosplenial Cortex**
- **Impacting areas 29, 30; marginally in PCC 23**
- 5 embolizations; 2 stereotactic radiosurgeries (1991, 1995)
- Neuropsychological evaluation in 1997—Severe verbal memory deficit.
- Normal appraisal and communication of prosody & facial expressions & normal appraisal of emotional sentences and words on FL Affect Battery
- Normal Recall of emotional autobiographical memories involving happiness, fear, and anger (Content & behavior appropriate to memory)

Control Subjects

- **Word Triplets** (n=5; 3 male, 2 female; Age = 44.0 ± 3.3)
- **Sentences** (n=12; 5 male, 7 female; Age = 32.9 ± 7.7)

Sample Trial of Sentence Startle Task



Sentence Stimuli: 2 per slide

- ✓ 4 Joy, 4 Neutral, & 4 Fear trials

You cringe as the large dog strains forward.

It snarls, with teeth bare, and leaps out at you.

You receive the letter confirming the unbelievable news!

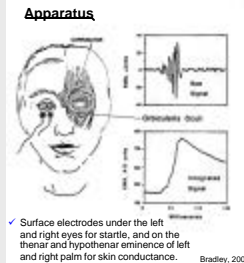
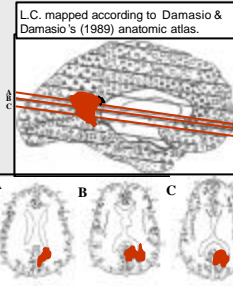
You've just won ten million dollars!

Torture
Death
Massacre

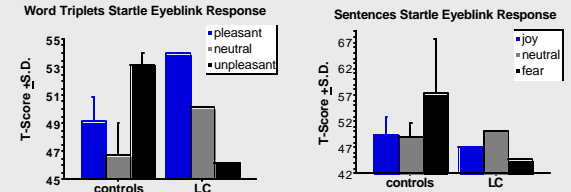
Joy
Love
Humor

Word Triplets Stimuli:

- ✓ 8 Positive, 8 Neutral, & 8 Negative Triplets

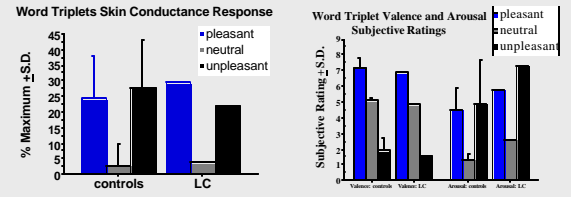


RESULTS



Word Triplet Controls: $F[2,8]=12.05, p<0.004, power=0.96$; Reliable difference between the unpleasant and pleasant pictures ($p=0.016; d=3.1$), and unpleasant and neutral pictures ($p=0.0013; d=4.2$), but not pleasant and neutral pictures ($p=0.11$).
Sentence Controls: $F[2,18]=5.09, p<0.02, power=0.75$; Reliable difference between the unpleasant and pleasant pictures ($p=0.01; d=1.4$), and unpleasant and neutral pictures ($p=0.016; d=1.2$), but not pleasant and neutral pictures ($p=0.8$).

❖ Our patient showed normal psychophysiological reactivity to emotional pictures, but markedly abnormal psychophysiological response to emotional words and sentences.



❖ Despite L.C.'s abnormal physiological response to emotion, he showed normal arousal to and appraisal of verbal emotional stimuli. Therefore, our results do not support the hypotheses that the retrosplenial region, or at least the left retrosplenial region, is involved in the ability to appraise emotional stimuli.

CONCLUSIONS

- ❖ This study represents the first human lesion study to implicate the RS cortex in emotion.
- ❖ Our results suggest that the left RS region may be part of a neural network essential for processing emotionally-salient verbal material.
- ❖ These findings corroborate imaging research suggesting that emotion processing within this region may be material-specific, supporting an association between the right retrosplenial cortex and emotionally salient pictorial stimuli and the left retrosplenial cortex and emotionally salient verbal stimuli (Cato et al., 2002; Maddock, 1999).

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