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Implicit and explicit memory for affective passages in temporal lobectomy patients

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Abstract

Eighteen temporal lobectomy patients (9 left, LTL; 9 right, RTL) were administered four verbal tasks, an Affective Implicit Task, a Neutral Implicit Task, an Affective Explicit Task, and a Neutral Explicit Task. For the Affective and Neutral Implicit Tasks, participants were timed while reading aloud passages with affective or neutral content, respectively, as quickly as possible, but not so quickly that they did not understand. A target verbal passage was repeated three times; this target passage was alternated with other previously unread passages, and all passages had the same number of words. The Explicit Affective and Neutral Tasks were administered at the end of testing, and consisted of multiple choice questions regarding passage content.

Verbal priming effects in terms of improved reading speed with repetition for the target but not non-target passages were found for patients with both left and right temporal lobectomies. As in the Burton, Rabin et al. [Burton, L., Rabin, L., Vardy, S.B., Frohlich, J., Wyatt, G., Dimitri, D., Constante, S., Guterman, E. (2004). Gender differences in implicit and explicit memory for affective passages. *Brain and Cognition, 54*(3), 218–224] normative study, there were no interactions between this priming effect and affective/neutral content. For the explicit tasks, items from the repeated passages were remembered better than the unrepeated passages, and there was a trend for information from the affective passages to be remembered better than the neutral passages, similar to the normative pattern.

The RTL group did not show the normative pattern of slower reading speed for affective compared to neutral passages that the LTL group showed. Thus, the present findings support the idea that intact right medial temporal structures are important for affective content to influence some aspects of verbal processing.

Keywords: Implicit memory; Affective memory; Verbal priming; Temporal lobectomy

1. Introduction

A variety of studies have evaluated material-specific explicit memory effects after temporal lobectomy. These studies generally report that after left temporal lobectomy including removal of the hippocampus and amygdala, there are decrements in verbal memory performance, and after right temporal lobectomy, there are decrements in visual memory performance (reviewed by Jones-Gotman, 1987; Leritz, Grande, & Bauer, 2006; Naugle, 1991; Phillips & McGlone, 1995). The verbal memory deficits seen after left temporal lobectomy include impaired memory for prose passages, words, and verbal paired associates, and the visual memory deficits include impaired recall of geometric designs and faces (i.e., Milner, 1967; Novelly et al., 1984; Phillips & McGlone, 1995; Rausch & Crandall, 1982; Savage, Saling, Davis, & Berkovic, 1992).

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1.1. Implicit memory in neurological groups

Most evaluations of *implicit* verbal memory in patients with temporal lobe abnormality have not reported impairment (i.e., Graf & Mandler, 1984; Warrington & Weiskrantz, 1974). For example, Billingsley, McAndrews, and Smith (2002) found the expected deficits in verbal explicit memory (word recall and recognition) after reading in left temporal lobe epilepsy patients, but no difference between the right and left temporal lobe epilepsy groups for verbal implicit memory (word identification and generation). Blaxton (1992) reported that patients with temporal lobe epilepsy performed normally on a verbal priming task using word-fragment completion, although performance was impaired on a conceptual verbal priming task, perhaps related to the greater difficulty of the latter task. Cermak, Verfaellie, and Chase (1995) reported impaired explicit verbal memory (graphemic cued recall) but normal verbal implicit memory (graphemic production) in amnesic patients of mixed etiology.

A study relevant to the present one by Musen, Shimamura, and Squire (1990) reported intact verbal priming in amnesic patients (mixed neurological abnormalities, including hippocampal atrophy, diencephalic abnormality, and Korsakoff's patients with mammillary or frontal abnormality). In their study, participants read two different passages three times, and improved reading speed (priming) was seen for both normal controls and the amnesic patients; the controls performed better than the amnesic subjects on questions about story content (explicit memory).

In sum, most studies on a variety of neurological patients indicate that medial temporal lobe lesions are associated with impairment in explicit, but not implicit memory, in a variety of paradigms.

1.2. Affective verbal explicit memory

Several studies have reported that emotional arousal or content leads to enhancement of *explicit* memory for both verbal and nonverbal material (i.e., Ceitlin, Dos Santos, Parisotto, Zannata, & Chaves, 1995; Granholm, Wolfe, & Butters, 1985; Hamann, 2001; Oscar-Berman, Hancock, Mildworf, Hutner, & Weber, 1990; Whissell, Povey, & Dewson, 1987). For words, emotionally charged words are remembered better than neutral words (Ceitlin et al., 1995; Doerksen & Shimamura, 2001). In neurological populations, it is most often reported that left hemisphere abnormality is associated with poorer affective verbal explicit memory than right hemisphere abnormality. A study by Burton, Gilliam, Flynn, and Labar (1999) used affective and neutral stories with temporal lobe epilepsy patients, and found that the left temporal lobe epilepsy patients made more distortions during recall of the affective than the neutral story. This effect was not seen for the right temporal lobe epilepsy patients. Burton, Vardy et al. (2004) evaluated temporal lobectomy patients and found the expected better performance by the right vs. left temporal lobectomy group for an affective paired associates task, and no group difference for neutral word pairs. Phelps, Spencer, and LaBar (1997) used two verbal affective memory tasks in temporal lobectomy patients and a control group. They found that the left and right temporal lobectomy patients showed the control pattern of better recall of emotional vs. neutral words, and better recall of neutral words in emotional sentences vs. neutral sentences, with the left temporal lobectomy group seeming to perform most poorly, although the statistics for this were not given.

The amygdala may be important in these affective verbal memory effects (i.e., Le Doux, 1995a, 1995b, 1996). For example, Cahill, Babinsky, Markowitsch, and McGaugh (1995) report a patient with bilateral amygdala damage who did not show the pattern of better memory for an emotional story than a neutral story that control subjects showed, in spite of a normal self-rating of emotional reactivity to the stories. Bechara et al. (1995) reported a double dissociation such that a patient with bilateral amygdala damage did not learn a conditioned response to a startling loud noise, but did acquire declarative (explicit) knowledge, and a patient with bilateral hippocampal damage did not acquire the declarative knowledge but did acquire the conditioned response. La Bar, Le Doux, Spencer, and Phelps (1995) showed that patients with unilateral temporal lobectomies which included removal of the amygdala showed impairment in conditioning to a loud noise in the context of intact unconditioned responses and good declarative memory for the task. La Bar et al. described this as a deficit in fear conditioning.

In sum, the literature indicates that emotional arousal or content leads to enhancement of *explicit* memory for both verbal and nonverbal material. The amygdala seems to have a special role in explicit affective memory, and the right hemisphere in general may be important in affective memory due to its special role in emotional processing.

1.3. Affective implicit memory

Only a few studies have evaluated *affective implicit* memory, and it is not clear whether the influence of affect on implicit memory is attributable to the amygdala or the right hemisphere's special emotional processing skills, or both. Babinsky et al. (1993) report a patient with bilateral amygdala damage due to Urbach-Wiethe disease who showed less *priming* for affective than neutral words on a word-stem completion task. Some researchers have evaluated affective implicit memory using combinations of verbal and nonverbal stimuli. Greve, Bauer, and Bowers (1991) investigated whether right hemisphere disease patients, who were impaired on explicit tests of facial affect recognition, showed implicit knowledge of affective facial expressions. Participants were shown affective faces (500 ms) that were immediately followed by a single congruent or incongruent emotion word (happy, sad, angry, or frightened). Participants were asked to read the word