



Recognition memory for pictorial material in subclinical depression

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ABSTRACT

Depression has been associated with impaired recollection of episodic details in tests of recognition memory that use verbal material. In two experiments, the remember/know procedure was employed to investigate the effects of dysphoric mood on recognition memory for pictorial materials that may not be subject to the same processing limitations found for verbal materials in depression. In Experiment 1, where the recognition test took place two weeks after encoding, subclinically depressed participants reported fewer know judgements which were likely to be at least partly due to a remember-to-know shift. Although pictures were accompanied by negative or neutral captions at encoding, no effect of captions on recognition memory was observed. In Experiment 2, where the recognition test occurred soon after viewing the pictures, subclinically depressed participants reported fewer remember judgements. All participants reported more remember judgements for pictures of emotionally negative content than pictures of neutral content. Together, these findings demonstrate that recognition memory for pictorial stimuli is compromised in dysphoric individuals in a way that is consistent with a recollection deficit for episodic detail and also reminiscent of that previously reported for verbal materials. These findings contribute to our developing understanding of how mood and memory interact.

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1. Dysphoric mood and its effects on memory for pictorial material

Depression is associated with impaired memory function. Previous findings have indicated that dysphoric mood specifically impairs recognition memory accompanied by the *recollection* of the encoding context in which material is first seen, and not recognition memory that is based in *familiarity* (Drakeford et al., 2010; Hertel & Milan, 1994; Jermann, Van der Linden, Adam, Ceschi, & Perroud, 2005; MacQueen et al., 2003; MacQueen, Galway, Hay, Young, & Joffe, 2002; Ramponi, Barnard, & Nimmo-Smith, 2004; see also Lemogne et al., 2006; Raes et al., 2006). Studies such as these have narrowed down the memory impairment associated with depression to the recollection component of recognition memory. This finding is of great significance as therapeutic interventions could exploit the spare, more automatic, capacity of familiarity-based recognition. Nevertheless, the recollection deficit remains poorly understood and replication has not been universal (see, Jermann, Van Der Linden, Laurençon, & Schmitt, 2009). In the current research, we investigated the effects of subclinical depression on the familiarity and recollection components of recognition memory for pictorial material as this allowed us to explore the important role that *visual* cognition plays in depressive ideation.

Visual processing, compared to verbal processing, is differentially influenced by depression, thus memory for pictorial material may differ substantially from memory for verbal material. For example, Baker and Jessup (1980) argue that verbal processing is more characteristic of depressive ideation than visual processing; when dysphoric participants were directed to process information visually (with mental images), rather than verbally, visual processing was rated as more euphoric than verbal processing. Bywaters, Andrade, and Turpin (2004) reported a positive correlation between sad mood and vivid imagery when recalling pictures, suggesting that visual processing was less susceptible than verbal processing to disruption in depression. The processing of images is likely to make use of resources that do not completely overlap with those required for verbal ideation as proposed in different models of working memory (Baddeley, 2007; Barnard, 1999). Image processing may thus distract from, rather than prompt, classic abstract depressogenic themes such as “failure.” On the basis of these kinds of evidence, it has been suggested (see, Holmes, Arntz, & Smucker, 2007) that mental imagery could be used in cognitive behaviour therapy in order to alleviate negative emotional symptoms. Yet, basic knowledge of the effects of sad mood on recognition memory for pictorial material remains sparse.

Pictures are informationally richer than words: whereas the word “telephone” covers a multitude of physical forms, a picture of a phone depicts a specific model of phone with some clearly delineated attributes and hence offers greater potential for recollection. In fact, memory for pictures is usually better than memory for words – the

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picture superiority effect. Dewhurst and Conway (1994) argued that pictures give rise more readily to an enriched automatic recollective experience because the encoding experience can be richer both perceptually and semantically. Dewhurst and Conway (1994) and Rajaram (1996) have demonstrated that in recognition memory, the picture superiority effect is confined to the recollection component by using the remember/know procedure (Gardiner, 1988; Tulving, 1985). After recognising a picture or a word as seen before, participants were asked to indicate whether they could recollect the encoding context, in which case they assigned a “remember” judgement, or whether they simply knew that they had come across the item before but could not recollect the context in which the item was first seen, (i.e. the item was familiar) in which case they assigned a “know” judgement. More remember judgements were reported for pictures than for words, whereas an equal or larger number of know judgements were reported for words relative to pictures. It has also been shown that different brain regions are involved in the recollection of pictures and words (Kensinger & Schacter, 2006; Woodruff, Johnson, Uncapher, & Rugg, 2005).

There is increasing evidence that the memory difficulties experienced in depression are better characterised as an impairment of recollection and not familiarity (Drakeford et al., 2010; Hertel & Milan, 1994; Jermann et al., 2005; MacQueen et al., 2002, 2003; Ramponi et al., 2004). Depressed individuals when recognising items presented previously, have little difficulty with realising that the item was seen before, but they have considerable difficulty remembering the item spatial or temporal context. More specifically, with the remember/know procedure, it was found that recognition responses assigned with remember judgements were reliably fewer in depressed (Drakeford et al., 2010) and subclinically depressed participants (Ramponi et al., 2004) than in controls, whereas the number of recognition responses assigned with know judgements did not differ reliably. The first goal of the present investigation was to determine whether the same pattern of impaired recollection and intact familiarity would be observed for pictorial stimuli. Given the arguments just exposed that dysphoric mood affects verbal, but not visual, processing, it was possible that spared visual processing capacity could offset any recollection deficit.

The second goal was to study the modulatory effect of the emotional content of memoranda on the recollection deficit. Emotional salience is known to have a very strong effect on memory for events (for reviews, see Buchanan, 2007; Hamann, 2001; Kensinger, 2004; LaBar & Cabeza, 2006). As life experiences worth remembering must be discriminated from experiences that can be forgotten without cost, emotional salience is a clear candidate for marking out particular experiences for privileged mnemonic access. The memory enhancing effect of emotion has been observed across a number of paradigms and for different events or stimulus types. There is also substantial evidence that emotional stimuli are better *recollected* than neutral ones (Dewhurst & Parry, 2000; Kensinger & Corkin, 2003) and that this holds for pictorial stimuli as well (Comblain, D'Argembeau, Van der Linden, & Aldenhoff, 2004; Dahl, Johansson, & Allwood, 2006; Dolcos, LaBar, & Cabeza, 2005; Ochsner, 2000; Sharot, Delgado, & Phelps, 2004; Sharot & Yonelinas, 2008; but see Aupee, 2007) and also that the emotional context in which to-be remembered items are appraised influences memory. Pre-experimentally neutral objects or words that are embedded in emotional pictures are better recalled than those embedded in neutral pictures (Erk et al., 2003) and show different neural activation patterns at retrieval (Smith, Henson, Rugg, & Dolan, 2005). Similar effects have been reported for the retrieval of neutral words (Maratos, Dolan, Morris, Henson, & Rugg, 2001) and pictures (Cahill & McGaugh, 1995) when the emotional context is determined by accompanying prose.

In depression, the memory enhancement effect for negative emotional material is even more pronounced. Depression has been linked with an abnormal appraisal of emotional stimuli (for a review

see Leppanen, 2006) that contributes to the onset and maintenance of depression. This distorted emotional information processing is reflected in enhanced memory for negative emotional material, i.e. material congruent with sad mood (Blaney, 1986; Elliott, Rubinsztein, Sahakian, & Dolan, 2002; Murphy et al., 1999). Cognitively, this effect is thought to be mediated by increased allocation of processing resources to negative material as more elaborate associations are generated to information consistent with an individual's current concerns (see Blaney, 1986; Williams, Watts, MacLeod, & Mathews, 1997). Neuroimaging investigations suggest that the abnormal amygdala activation typically associated with sad mood (for a review see Drevets, 2003) may mediate the memory enhancement of negative material (Moritz, Gläscher, & Brassen, 2005).

The memory enhancing effect for negative material in depressed individuals has been observed for faces that vary in emotional expression (Gilboa-Schechtman, Erhard-Weiss, & Jeczemien, 2002; Ridout, Astell, Reid, Glen, & O'Carroll, 2003; Ridout, Noreen, & Johal, 2009) and Jermann, Van der Linden, and D'Argembeau (2008) observed that this recognition memory enhancement was captured specifically by the recollection component, as is the case for words (Jermann et al., 2009; Lewis, Critchley, Smith, & Dolan, 2005). Whether pictures of scenes that have negative emotional connotations are also better retained by participants experiencing dysphoric mood, potentially offsetting the general recollection impairment remains unclear (for example see Jermann et al., 2009). This question was addressed in the current research by comparing dysphoric and control participants on recognition memory for pictures varying on an emotional dimension. In the present investigation, we tested, first, whether subclinically depressed participants demonstrated impaired recollection and intact familiarity for pictures, and second, whether emotion can modulate picture memory.

2. Experiment 1

Experiment 1 evaluated the effect of mood on recollection for neutral pictures that did not convey inherent affective information. It was possible that a recollection deficit parallel to that found for verbal material (Drakeford et al., 2010; Ramponi et al., 2004) would be observed, although any deficit could be offset by a relative preserved visual processing capacity.

The remember/know procedure was employed to explore which component of picture recognition, if any, is affected by dysphoric mood. Contrary to previous protocol for verbal materials, we followed the precedent set by Ochsner (2000) for pictorial materials so that ceiling effect could be avoided and did not test memory immediately, but after a two-week delay. With this significant delay between study and test, a recollection deficit can also be expected to be evident as a reduction in the number of *know* judgements. Recognition responses that are initially assigned a remember judgement are later on experienced with a *know*-type awareness because of the loss of episodic detail, i.e. a “remember-to-know” shift occurs (Conway, Gardiner, Perfect, Anderson, & Cohen, 1997; Dudukovic & Knowlton, 2006; Herbert & Burt, 2003, 2004; Knowlton & Squire, 1995). If at shorter delays depressed participants initially report fewer ‘remember’ judgements, at longer delays when the episodic details are lost and remembering becomes knowing, they would be expected to report fewer ‘know’ judgements. Consequently, at long intervals the recollection deficit associated with dysphoric mood can be expected to be reflected in know judgements.

We also explored whether biasing the processing of pictures with an emotional or neutral interpretation affected memory. Picture processing was biased with the use of picture captions that participants were asked to read and evaluate when viewing the picture (Teasdale et al., 1999). For example, an image of a staircase could be paired with the caption ‘where Johnny had a bad fall’ (negative context), whereas the same image of a staircase could be

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