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# Information processing biases in emotional disorders

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## Thesis abstract

This thesis addresses information processing biases that occur in emotional disorders. In particular, the thesis focuses on interpretation biases in depression. Three cognitive models are drawn upon to examine how information processing biases differ between emotional states. In depression, individuals show biases in memory for negative information when strategic, elaborate cognitive processing occurs. In anxiety disorders, there appears to be an initial (automatic) attentional bias to threatening information. These differences in processing may contribute to the development and maintenance of emotional disorders. However, the literature examining interpretation biases has been criticised for introducing response bias and experimental demand effects in the methodologies. Whilst it appears that interpretation biases occur in anxious states, this does not appear to occur in depressed states when using more sophisticated methodologies. The paper comments on ways this could be researched further. Clinical implications for and against an interpretation bias occurring in depression are proposed.

The empirical study tested the hypothesis that clinically depressed individuals will interpret ambiguous material negatively when using a design that removes response bias and experimental demand effects. Although the results show a negative interpretation bias on a homophone task, this bias does not appear to occur when using a more sophisticated methodology. However, the present study has several limitations in the design that may account for these findings. Further research is required before firm conclusions can be made.

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# Biases in information processing

# in the emotional disorders, in particular, clinical depression

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# Biases in information processing in the emotional disorders, in particular, clinical depression


## Abstract

This paper discusses cognitive processing biases that occur in emotional disorders, in particular depression. Three information processing models are considered to help understand the possible development and maintenance of emotional disorders. Four core processes are explored – memory bias, attentional bias, and biases in judgement and interpretation. In depression, individuals appear to have cognitive biases in strategic processes, such as explicit memory for negative information, whilst anxious individuals often do not show such a memory bias. However, in anxiety disorders, individuals show a selective attentional bias to threatening information. This is often not found in depressive states.

The paper also discusses research findings in interpretation biases. Whilst it appears that anxious individuals interpret ambiguous information negatively, the evidence of interpretative biases in depressed individuals is uncertain. A review of the literature highlights the need for further research in depression and the interpretation of ambiguity. Clinical implications include using cognitive behavioural strategies aimed at reducing negative interpretations if this bias is found in depression.


Key Words: information processing, cognitive bias, depression, interpretation bias.

## Biases in information processing in the emotional disorders, in particular, clinical depression

There has been a growing body of literature over the last two decades that has applied cognitive psychology to the study of emotional disorders, such as depression and anxiety (e.g., Williams, Watts, MacLeod & Mathews, 1988, 1997). There is increasing evidence that individuals with emotional disorders show patterns of cognitive biases when processing emotional information. One research aim has been to develop and apply information processing paradigms to the emotional disorders in order to help understand their development and possible maintenance. This interest has resulted in the development of cognitive models of depression and anxiety (Dagleish & Watts, 1990). The paper will begin with a clinical overview of depression and models of depression, including biological, psychodynamic, behavioural and cognitive models. The paper will focus on cognitive models that have been applied to the processing of information in emotional disorders, including both depression and anxiety. The paper will examine the evidence available for information processing models. Four core processes will be explored – memory bias, attentional bias, and biases in judgement and interpretation. Finally, key clinical implications and future research directions will be discussed.

## Clinical overview of depression

Definition of emotion. An emotion, or mood is a wide-ranging phenomenon and incorporates different facets. Greenberger and Padesky (1995) discuss how emotions can affect behaviour, cognition and physiology and in order to understand emotion these links need to be acknowledged. Emotional disorders can be described as "long-term emotional disturbance and preoccupation" (Williams et al., 1997), with depression and anxiety as

the most common emotional disorders. There is a large variation in the degree of emotional disturbance that people experience and not everyone who has an emotional disorder is a 'patient' (Williams et al., 1997). Emotion can either be 'trait' e.g., chronic emotional vulnerability or 'state' e.g., momentarily experiencing acute emotional arousal. Both trait and state emotions will effect cognitive processing, although individuals who experience both simultaneously may have the largest effect (Williams et al., 1997). This review paper will be focusing on depression.

Prevalence. Depression is the most widespread psychological disorder, with 15-20% of adults suffering with depression at any given time (Fennell, 1989; Williams et al., 1997). Approximately 75% of psychiatric hospital admissions are for depression, with women being twice as likely as men to develop depressive symptomatology (Brown & Harris, 1978).

Definition of depression. The Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; American Psychiatric Association, 1994) has divided clinical depression, as opposed to a transient low mood, into several categories. Unipolar depression (or major depressive disorder) identifies depressive symptoms without manic episodes. In bipolar depression, both depression and mania occur episodically (Rosenhan & Seligman, 1989). This review paper will be looking at unipolar depression only. Distinctions have also been made between episodic and chronic depression, and endogenous and reactive depression. According to DSM-IV, chronic depression or dysthymia describes an individual who has been depressed for at least two years, without a return to normal mood for two months in duration. Fifteen to 20% of depressed people follow this chronic course (Fennell, 1989; Dagleish & Power, 1999). In episodic depression, the duration is shorter, with a clear onset and distinction from previous non-depressed functioning. For the majority of people the course of depression is time-limited.

Untreated episodes of depression often last between three to six months although relapse is common (Fennell, 1989).

The endogenous and reactive depression categories attempt to distinguish biological and psychological based depression. Endogenous depression is thought to arise from biological changes within the individual, whereas reactive depression is precipitated by life stressors (Rosenhan & Seligman, 1989; Dagleish & Power, 1999). However, the usefulness of this distinction has been criticised since there appears to be no difference in the number of precipitating events prior to the onset of depression (Leff, Roatch & Bunney, 1970).

Clinical presentation of depression. Although most people have experienced low mood at times following life stresses, clinical depression differs from this by resulting in a disturbance in several areas of functioning. DSM-IV defines major depression in four main sets of symptoms. Firstly, mood or emotional symptoms include sadness, irritability, anxiety and tension, or feelings of numbness and detachment. Secondly, thought or cognitive symptoms include feelings of guilt, worthlessness and a negative view of the self. This can result in feelings of hopelessness about the world and the future, and can result in suicidal thoughts and actions. Research has found suicide rates to be as high as 15% among severely depressed individuals (Coryell & Winokur, 1982). Thirdly, motivational symptoms include withdrawal from activities due to loss of interest or inability to experience enjoyment. In severe depression psychomotor retardation can also occur (Williams et al., 1997). Finally, physical or somatic symptoms include disturbances in basic bodily functions. These disturbances include changes in sleep, appetite and libido patterns.

To meet the criteria for unipolar depression, DSM-IV specifies that five of the nine specific depressive symptoms must be present. These symptoms must be present on

most days for at least two weeks, and must be distinguished from normal reactions to loss, death etc, for a diagnosis to be made.

This review paper will now explore some models that have been developed to help understand and explain the cause of depression. Four main models have been postulated: biological, psychodynamic, behavioural and cognitive models. These will be briefly described in turn, although the cognitive models will be described in more detail.

## Models of depression

There has been a considerable amount of research that attempts to understand the causes of depression and how it can be best treated. Different models of depression do overlap, as do the recommended therapies. This review paper will explore the models of depression rather than the treatment approaches, with the aim of understanding the information processes involved.

### Biological models of depression

The biological models regard depression as a disorder of the body and explore the role of neurochemicals (e.g., serotonin), and genetics in the development and maintenance of depression (Rosenhan & Seligman, 1989). Evidence for the neurochemical model involves the effects of antidepressants and electroconvulsive therapy on alleviating symptoms. Evidence for the genetic model comes from similarities in depressive symptoms across different cultures, ages, gender, and within families, which indicates an underlying biological component (Rosenhan & Seligman, 1989). For example, first-degree relatives of individuals with unipolar depression have between two and five times the risk of depression compared to the normal population (Weissman, Kidd & Prusoff, 1982). Twin studies have also suggested high rates of concordance in monozygotic as

opposed to dizygotic twins, although this concordance is higher for bipolar than unipolar depression (Rosenhan & Seligman, 1989).

However, research has shown that a combined treatment approach of medication and cognitive behavioural therapy may be more effective in the treatment of depression than medication alone (Blackburn, Bishop, Glen, Whalley & Christie, 1981; Murphy, Simons, Wetzel, & Lustman, 1984). This suggests that the biological models alone are weak in understanding the cause of depression. However, although the outcome studies were criticised for lack of placebo, lack of controls, small sample sizes, low medication dosages and outcomes based on a reduction in symptomatology only (Roth & Fonagy, 1996), alternative models have been developed. These will now be discussed.

Psychodynamic models of depression

Psychodynamic theories have been based upon the work of Freud (1917), and describe depression as a result of anger turned against the self, dependence on others for self-esteem and helplessness about achieving one's own goals (Rosenhan & Seligman, 1989). According to Freud (1917), the depressed individual experienced (in childhood) an intense love that was undermined by disappointment by others. The individual experienced rage at this disappointment. Instead of the libidinal energy of love attaching to the other person, it is turned to the ego. This results in the rage directed to the self. Later losses and rejections trigger the rage associated with the original person, but because the rage is now directed to the self, low self-esteem and depression result. However, most people who suffer losses do not develop emotional problems. In addition, individuals who experience parental loss may also develop mental health difficulties other than depression (Atkinson, Atkinson, Smith, Bem & Hilgard, 1990).

Bibring's (1953) theory claims that depression arises when the ego feels helpless to achieve the high standards that the individual sets for himself/herself. Other theorists

e.g., Rado (1928) believed that the depressed individual needs to feel loved and admired by others, with self-esteem depending on this process. The individual has difficulties in tolerating loss and frustration and this results in a need to end the discomfort, by seeking love from others. Since there has been little research evidence supporting psychodynamic models (Rosenhan & Seligman, 1989), other models have been developed.

Behavioural models of depression

Behavioural theorists believe that a lack of positive reinforcement and/or a high rate of negative experiences can result in depression (Lewinsohn, Mischel, Chaplin & Barton, 1980). In addition, people prone to depression may lack the social skills required to receive positive reinforcement from others. Once depressed, the individual is likely to become more isolated, thus reducing positive reinforcement further and increasing depression (Atkinson et al., 1990). However, increasing pleasant activities does not always improve mood, and may be a consequence and not a cause of depression (Lewinsohn et al., 1980). In general, the behavioural models can be criticised for ignoring subjective experiences, in particular distorted thoughts, attitudes and beliefs.

The learned helplessness theory of depression, however, is based on the behavioural work of Maier and Seligman (1976), but also emphasises the role of cognitive processes. This theory predicts that the depressed individual expects that bad things will happen, and that there is nothing that can be done to prevent it from happening. Thus, there is no link between behaviour and outcome, resulting in difficulties in motivation.

The learned helplessness theory has elements in common with cognitive models of depression. Three information processing models have been of particular importance when considering cognitive models of depression. These include Beck's (1967, 1976)

schema model, Bower's (1981) network theory and Williams et al's. (1988, 1997) information processing theory. These cognitive models will now be described.

## Cognitive models of depression

Definition of cognition. 'Cognition' is a multifaceted phenomena and includes a wide range of information processes, including memory (encoding, recall and retrieval), attention, judgement and interpretation. These levels of processing can be unconscious and conscious (Williams et al., 1997). In addition, cognition also refers to the thoughts, beliefs and assumptions that an individual has (Beck, 1967, 1976). Research has shown that cognitions can alter as an individual experiences different emotional states (Williams et al., 1997).

Cognitive models have been of particular importance when considering information processing in emotional disorders. Information processing theories can help to understand the relationship between cognition and emotion. In particular, they can help to determine which information is attended to and how it is interpreted, encoded and recalled. Furthermore, both the conscious and unconscious processing of information can be explored (Williams et al., 1997).

Beck's (1967, 1976) schema model. This cognitive model of depression evolved from experimental testing and clinical observations (Beck, Rush, Shaw & Emery, 1979). It has four main components to the model: the cognitive triad, schemas, dysfunctional assumptions and cognitive biases. These will be discussed in turn.

The cognitive triad. The cognitive triad refers to negative views of the self, the world and the future. The self is seen as defective, worthless and inadequate, with unpleasant experiences attributed to personal inadequacies. The world and ongoing experiences are also viewed negatively. The world is seen as demanding and bad (Beck et al., 1979). The future is also viewed as hopeless and one of hardship and suffering. The

symptoms of depression are considered to be a consequence of this negative thinking style (Beck et al., 1979). These negative automatic thoughts (NATs) about the self, the world and the future, occur rapidly, with the individual having little control over them (Beck, 1967). The content of NATs reflect the content of the underlying belief system that an individual has. Once the belief system is activated, thinking becomes more negative, and more appropriate beliefs are less likely to be activated. This belief system combines a number of 'schemas' which will now be discussed.

Schemas. Beck's (1967, 1976) model of depression suggests that early experiences cause an individual to develop assumptions or schemas about the self, the world and others. Schemas are stable cognitive patterns which are used to understand, structure and evaluate experiences, and act as a filter in information processing. Each individual has idiosyncratic schemas that can be inactive for a period of time. Beck (1967, 1976) argues that cognitive biases in emotional disorders exist due to the activation of negative schemas. Problems arise when critical incidents trigger the schema. When in an emotional state, the individual will selectively process and distort information in order to fit the schema. In severe depression, the individual will find it more and more difficult to think objectively. Beck's (1967, 1976) theory, therefore, states that vulnerability to emotional disorders, and the maintenance of the disorder is associated with the activation of underlying negative schemas. The activation of the negative schemas occurs along with changes in information processing. These changes include an increase in NATs about the self, the world and the future (as discussed), dysfunctional underlying assumptions and cognitive biases.

Dysfunctional assumptions. Dysfunctional assumptions are fundamental rules or principles that guide behaviour. They are conditional beliefs that underlie the NATs e.g., "If people do not like me, then it means I am worthless" as opposed to the absolute beliefs

of the schemas e.g., "I am worthless" (Padesky, 2000). In depression, the self is perceived as inadequate, defective and worthless. In an anxiety disorder, dysfunctional assumptions are about personal danger and a reduced ability to cope with the situation (Wells & Matthews, 1994). One result of the activation of NATs, schemas and dysfunctional assumptions is the introduction of bias and distortion in cognitive processing. These cognitive biases serve to maintain the distress, by the effect that they have on encoding, comprehension and the retrieval of information.

Cognitive biases. Beck et al. (1979) also describe systematic errors in logic that serve to maintain the individual's depressive beliefs, despite contradictory evidence being available. These logical errors are also known as cognitive biases or faulty information processing and arise from deeper levels of cognition (e.g., schemas). Cognitive biases include arbitrary inferences (drawing conclusions with little or no evidence), selective abstraction (focusing on small details and ignoring more important facts), overgeneralisation (drawing global conclusions from small facts), personalisation (blaming the self when there is no evidence), dichotomous thinking (placing all experiences in extreme opposite categories) and magnification (of negative events) and minimalisation (of positive events).

However, Beck's (1967, 1976) cognitive model has been criticised since it does not account for differences in information processing biases that are found in depression and anxiety e.g., differences in memory, attention and interpretation. Other cognitive models have therefore been developed (e.g., Williams et al., 1988, 1997). However, before discussing these, Bower's (1981) cognitive model will next be discussed.

Bower's (1981) Network Theory. This model was developed further by Bower and Cohen (1982), Gilligan and Bower (1984) and Bower (1987). Bower's (1981, 1987) cognitive model suggests that emotions are associated with the activation of emotion

nodes (or units) that exist in the memory system. Emotion nodes activate the memories (represented as event or concept nodes) associated with the emotion. Therefore, when an individual is depressed or anxious they will be primed to perceive, remember and attend to any information or stimuli consistent with the emotion (Wells & Matthews, 1994).

Bower (1981) identifies three important ways in which emotion influences information processing. Firstly, mood state-dependent retrieval occurs when encoded material is associated with nodes for contextual features, including emotional state. During retrieval, if the individual experiences the same emotional state as when material was encoded, then the emotional node will prime the nodes for material to be remembered, making it more accessible (and vice versa). Secondly, mood-congruent retrieval links emotional nodes to nodes associated with concepts or events. For example, a depressed mood will increase the activation of nodes for negative events and concepts. This increases the degree to which these memories are recalled. Thirdly, similar priming effects are found for other cognitive processes, including perception, attention and interpretation. Teasdale (1983) integrates both Bower's (1981) and Beck's (1967, 1976) model in his 'differential activation hypothesis', and suggests that vulnerability to enduring depression depends on how negative cognitions are accessed once an individual initially becomes depressed.

Although Bower's (1981) network theory generated further research (Wells & Matthews, 1994), it does have limitations. Not only does it fail to explain differences between state and trait emotion on information processing, but it also has limited use in predicting which information processing tasks are most affected by emotional bias (Wells & Matthews, 1994). In addition, Williams et al. (1988, 1997) suggest that the model fails to account for retrieval processes associated with memory. As with Beck's (1967, 1976)

model, Bower's (1981) model also fails to distinguish differences in cognitive biases found in depression and anxiety.

Williams et al's. (1988, 1997) information processing model. Williams et al. (1988, 1997) have developed an information processing model that helps to overcome some of the difficulties associated with Beck's (1967, 1976) and Bower's (1981, 1987) cognitive models. This model distinguishes between priming (or activation) and elaboration of stimuli that is cognitively processed (either consciously or unconsciously) by the individual. It also differentiates biases associated with trait and state depression and anxiety, and places them at different stages of information processing with respect to attention and memory (Wells & Matthews, 1994). These differences in information processing result in distinct cognitive biases that occur in depression and anxiety.

Firstly, Williams et al. (1988, 1997) argue that anxious individuals selectively attend to material perceived as threatening, whereas non-anxious individuals tend to allocate resources to non-threatening material. This anxiety bias is thought to occur at a pre-attentive stage and involves automatic processing and attention towards threat material. This automatic processing is different from Beck's (1967, 1976) concept of automatic thoughts, since negative automatic thoughts intrude into the consciousness, whilst automatic processing tends to occur outside of consciousness (Dagleish & Watts, 1990). Two mechanisms are responsible for this pre-attentive bias in anxiety (Williams et al., 1988). The Affective Decision Mechanism (ADM) assesses the degree of threat in a situation, and the output is sent to the Resource Allocation Mechanism (RAM). The RAM is influenced by trait anxiety. According to this model, high trait individuals shift attention to threat, whilst low trait individuals shift attention away from threat. As state anxiety increases, this process increases.

Secondly, according to Williams et al. (1988, 1997), depression influences information processing when stimulus identification and elaborate processing occurs (i.e., further processing of the relationships between stimuli and context). This results in depressed individuals, and not anxious individuals, having a facilitated memory for negative information. However, this memory bias does appear to arise primarily from the recall of personally relevant negative material, rather than negative information in general (Teasdale & Russell, 1983).

Thirdly, according to Williams et al. (1988, 1997), an interpretative bias that favours the more negative/threatening meanings of words in depression and anxiety respectively occurs. However, this interpretative bias will depend on whether information is processed pre-attentively or elaborately, with depressed individuals showing an interpretative bias when further (elaborate) processing occurs. Evidence for differences in information processing in depression and anxiety will be examined later.

In sum, although it is accepted that the emotional disorders are associated with cognitive biases, and that these biases are thought to have a crucial role in the maintenance and possibly the development of emotional disorders (Williams et al., 1997), the extent of such biases is still questioned. Whilst Beck's (1967, 1976) and Bower's (1981) cognitive models are only partially supported, Williams et al. (1988, 1997) offer an alternative model. This model argues that cognitive biases are specific to certain processing mechanisms. For example, depression is concerned with biases for negative information in controlled strategic processes, whilst anxiety is concerned with biases in pre-attentive and attentional processes. However, a key problem with Williams et al's. (1988, 1997) theory concerns the evidence of whether information processing biases are state-dependent or as a consequence of vulnerability factors e.g., trait-dependent (Dagleish & Power, 1999).

Summary

Four main theoretical approaches have attempted to understand the cause of depression, and how it can be best treated. These include biological, psychodynamic, behavioural and cognitive models. However, each model is multifaceted and has its strengths and weaknesses. Having a knowledge of the different models and drawing upon different aspects of each may be more appropriate to understand depression.

This review paper focuses on cognitive models of depression, and explores what different cognitive theories say about information processing biases in depression. The paper will, therefore, be discussing different types of cognitive biases that are found in depression, and whether these biases are specific to depression or whether they are also found in anxiety states.

## What do cognitive theories say about cognitive biases in depression?

According to Beck's (1967, 1976) and Bower's (1981) cognitive models, a negative memory bias is predicted in depressed and anxious individuals. Williams et al. (1988, 1997) predict a negative memory bias, unique to depressed states. Beck's (1967, 1976) and Bower's (1981) models also predict attentional bias for negative information in depressed states, although there would be content specificity effects (e.g., the content must be depressed-related in order to produce attentional bias). However, Williams et al's. (1988, 1997) model would predict no attentional bias in depression, since strategic processing would not necessarily have occurred. In terms of judgement and interpretation, Beck (1967, 1976) and Bower (1981) would predict negative processing of information, corresponding with the activation of negative schemata and memory nodes. Williams et al. (1988, 1997) also predict a negative bias since the processing may be elaborate rather than pre-attentive.

In order to assess the research evidence for the different cognitive models, the review paper will now focus on specific cognitive biases in depression and whether the biases are specific to depression, or also found in states of anxiety. These include biases in memory, attention, judgement and interpretation.

## Cognitive biases in depression and anxiety

Research has shown that individuals with depression or anxiety have several cognitive biases when processing emotional information. For example, people with depression tend to recall more unhappy than happy memories (Mineka & Sutton, 1992), notice their failures rather than their successes and evaluate themselves more negatively than non-depressed controls (Roth & Rehm, 1980). People with high anxiety levels tend to select and interpret information in a threatening way (Mathews & MacLeod, 1994). Similar cognitive biases have been found in alcohol misuse (Johnsen, Laberg, Cox, Vaksdal & Hugdahl, 1994) and bulimia (McManus, Waller & Chadwick, 1996).

The review paper will explore four common information processing phenomena (cognitive biases) in depression and anxiety. These include biases in memory, attention, judgement and interpretation. These cognitive biases will be examined in terms of the information processing models previously described: Beck (1967, 1976), Bower (1981) and Williams et al. (1988, 1997).

### Memory: Methodological paradigms and empirical findings

There is a large amount of literature on depression and memory that has looked at two main phenomena: mood-state dependent memory (MSD) and mood congruence memory (MCM) (Wells & Matthews, 1994). MSD refers to neutral material that is better remembered when moods at the encoding and retrieval stages are similar. MCM refers to improved memory for items whose affective content matches mood at the encoding

and/or retrieval level (Wells & Matthews, 1994). This can be understood by Bower's (1981) model as described previously. Studies of MCM have typically compared depressed and non-depressed individuals on different memory tasks (encoding, recall, recognition, autobiographical memory) and have used material differing in affective content.

Williams et al. (1988) reviewed the literature on memory and affect, and found that depressed people tend to have a biased recall for negative rather than positive information. In addition, it was found that non-depressed people have a biased memory for positive information. Other researchers believe that a negative recall bias only exists in depression when the material is personally relevant to the individual (Teasdale & Russell, 1983). However, a memory bias appears to exist for mood induction studies as well as in clinical depression, and regardless of whether the material is presented autobiographically or experimentally (Mineka & Sutton, 1992). MacLeod and Salaminiou (2001) found that depressed individuals have a reduced positive anticipation to future events. This was not found in anxiety states. These results are consistent with the idea that depressed individuals have difficulties accessing mental representations of positive experiences, including memory.

In terms of clinical implications, Teasdale (1988) argues that the negative memory bias may create a vicious cycle of depression, since the biased memory for negative information may increase depressive symptoms. Brittlebank, Scott, Williams and Perrier (1993) found that even when they controlled for severity of depression in depressed patients, the presence of memory biases predicted higher levels of depression three to seven months later. Information processing models can, therefore, increase clinical understanding of emotional disorders and may suggest appropriate ways to intervene.

Derry and Kuiper (1981) found that clinical depressives have a self-referent recall bias for negative and not positive words, whilst non-depressed individuals have a bias towards the positive words. However, Bradley and Mathews (1983) found a negative recall bias in depression for self-referent information and not for information about others. Thus, these results cannot be attributed to a general bias in depression, since the bias appears to be negative only for self-referent information (Williams et al., 1997).

More recent studies (Bradley, Mogg & Williams, 1995) have attempted to look at implicit memory biases for negative information, rather than asking individuals to recall explicit prior experiences. Implicit memory tasks assess the effect of previously presented information on performance (e.g., priming of lexical decision tasks) without requiring the person to deliberately remember the information. This implicit memory bias is potentially informative clinically, since it suggests that information is selectively processed without any conscious effort to do so, (rather than the bias being a function of the explicit memory tasks). However, although research has found that explicit tests of memory produces negative memory biases in depressed individuals (Denny & Hunt, 1992; Watkins, Mathews, Williams & Fuller, 1992), implicit memory tasks produce mixed results. Some studies tend not to have shown significant negative implicit memory biases in depressed states (Denny & Hunt, 1992), although other studies have done (e.g., Bradley et al., 1995). Williams et al. (1988, 1997) suggest that the negative bias operates in strategic processing, and so should be seen in explicit rather than implicit memory. However, research findings on this issue are mixed.

There is less evidence that anxiety is related to biases in memory, such as on recall and recognition tasks (Mathews & MacLeod, 1994). Although Mathews, Mogg, May and Eysenck (1989) suggested an implicit memory bias for threatening information in anxiety, later studies failed to replicate this (Mathews, Mogg, Kentish & Eysenck, 1995; Bradley,

et al., 1995). In addition, only a few studies have found an explicit memory bias in anxiety states (e.g., Greenberg & Beck, 1989; Mogg & Mathews, 1990). This suggests that depression and anxiety may have different effects on information processing. This gives some support for Williams et al's. (1988, 1997) model that states different moods have different effects on information processing, and highlights limitations of Beck's (1967, 1976) and Bower's (1981) models. Beck's (1967, 1976) model predicts similarities in information processing for the two clinical disorders. That is, there should be biases operating in all aspects of processing (including attention and memory) in anxiety and depression, although the emotional content needs to be specific to the schema (e.g., negative-related biases in depression and threat-related biases in anxiety). Bower's (1981) model does not predict differences between emotions and biases in memory. More specifically, the model predicts that depression and anxiety enhance encoding and retrieval of material congruent with the mood state (Williams et al., 1997).

In summary, there is a large amount of literature on memory biases in depression and anxiety. Whilst it appears that depression has a relatively consistent effect on explicit memory, there is mixed evidence for an implicit negative memory bias in depressed states. In contrast, some research has shown that anxious individuals appear to have implicit negative memory biases, but evidence for explicit memory biases in anxiety is mixed. The literature review paper will now look at biases in attention.

Attentional bias: Methodological paradigms, empirical findings and theoretical ideas

Attention has been described as the selection of specific stimuli for further information processing. An attentional bias is thought to occur when there is a change in an individual's focus of attention. One aspect of the environment will be attended to more than other aspects (Williams et al., 1997).

Attentional tasks have been used to examine biases in pre-conscious and selective attention (e.g., Bradley, Mogg & Lee, 1997). To date, most research on attentional bias has focused on anxiety with less focus on depression. This review paper will now explore some of the research that has examined attentional biases in both depression and anxiety, and will explore what the cognitive theories have said about attentional biases.

Several experimental techniques have been devised to determine whether people with depression or anxiety have an encoding bias to emotionally negative information. The Stroop and dot probe tasks have been the most frequently used experimental tasks. The modified Stroop task, which is an interference task, requires subjects to name the colour of a presented word, but ignore the word content. In general, studies looking at attentional biases in depression have produced mixed findings (Wells & Matthews, 1994). Although some attentional biases have been found for depressed individuals (Gotlib & MacCann, 1984), it has been suggested that the results may be due to the effects of co-morbid anxiety, rather than depression per se (MacLeod & Mathews, 1991). Williams and Nulty (1986) did find that a depressed group showed a greater attentional bias on a modified Stroop task than a non-depressed group, and that this biasing effect was not found after recovery (Gotlib & Cane, 1987). Research has shown more consistent results for anxiety, with anxious individuals showing longer colour-naming latencies for threat related words, than neutral words (e.g., Mathews & MacLeod, 1985). This suggests that individuals with anxiety have difficulties in ignoring the emotional content of the stimuli.

The Stroop task has, however, been criticised for a possible response bias in the results. That is, individuals may have a tendency to respond to emotional words, causing an interference in the colour-naming task at the response output stage, rather than the emotional words causing attentional bias (MacLeod, Mathews & Tata, 1986). This

prompted the development of the dot-probe task, which provides a more direct measure of attentional bias.

The dot-probe task is an attentional task in which participants are presented simultaneously (on each trial) with one negative word and one neutral word on a computer screen for half a second (MacLeod et al., 1986). They are then required to identify the location of a dot on the screen, which replaces one of the words. The response times to the dot probes provide a measure of attentional bias to the word stimuli. Studies that have used the dot probe task (or variants of the task) have not consistently found an attentional bias towards negative information in individuals with depression (Gotlib, McLachlan & Katz, 1988; Matthews & Antes, 1992; Mogg, Bradley & Williams, 1995). MacLeod et al. (1986) examined both depressed and anxious individuals on the same dot probe task. The depressed individuals showed no evidence of biased information processing, although anxious individuals did. Attentional biases in depression have been found on tasks that have used longer exposure times (Mogg et al., 1995; Bradley et al., 1997). However, attentional biases may be due to the effects of anxiety, depression or a mixture of both states. Co-morbidity is a difficulty in this area of research since depression and anxiety do tend to occur together. This is a limitation of Williams et al's. (1988, 1997) model since they fail to discuss the implications of co-morbidity (Mogg et al., 1995).

The research findings in attentional bias in anxiety have produced fairly consistent findings using dot-probe tasks. MacLeod et al. (1986) found that anxious individuals have increased detection latencies for dots that were presented nearer to the negative word. This suggests that anxious individuals have a biased attention towards emotionally negative stimuli. These results were also found by Broadbent and Broadbent (1988), MacLeod and Mathews (1988) and Mogg, Mathews and Eysenck (1992). Although

anxious individuals attend to stimuli related to their emotional concerns, it does not imply, however, that further information processing is carried out (Dagleish & Watts, 1990).

Thus, there appears to be fairly consistent evidence of attentional biases in anxiety, whereas evidence of such biases in depression is mixed (and is more commonly found at longer stimulus duration). These differences in attentional bias in depression and anxiety contrast with Beck's (1967, 1976) theory, which predicts that the same cognitive biases occur in depression and anxiety, and across different cognitive processes e.g., attention and memory. The research suggests that different cognitive processes occur in individuals with depression and anxiety. However, these mood specific differences in attentional bias are explained by Williams et al's. (1988, 1997) model. They suggest that cognitive biases in anxious individuals occur at early stages of processing, prior to awareness, and can be observed in the selective attention tasks. However, in depression, cognitive biases occur at strategic levels e.g., memory and recall, rather than in pre-conscious, selective attention. Thus, whilst anxious individuals rapidly shift attention to threat (possibly as a result of automatic, pre-conscious process), depressed people do not, unless negative information has come into the conscious processing system. Once negative information has entered awareness, depressed people may then tend to find it difficult to switch attention away from it (Bradley et al., 1997).

In summary, the emotional Stroop tasks and dot-probe tasks have been the most promising in highlighting attentional bias. Research has shown strong evidence for attentional bias in anxiety, but not consistently in depression. This suggests a pre-conscious attentional bias in anxiety and a strategic bias in depression, indicating different information processes in the emotional disorders.

This literature review will now look at the effects of depression and anxiety on cognitive processes involved in judgement.

Judgement: Methodological paradigms and empirical findings

Evidence for biases in judgement have been found in both depressed and anxious states. Research in this area has been considerably less than attentional and memory biases. Emotional states have been found to affect judgements of past performance, and future risk (Williams et al., 1997). For example, MacLeod and Bryne (1996) compared depressed and anxious individuals on their anticipation of positive and negative future experiences. When compared to controls, depressed individuals have a greater expectation of negative events, and a reduced anticipation of positive events occurring. Anxious individuals also show an anticipation bias for negative events. However, the depressed group also had elevated anxiety levels, so the results may have been due to anxiety rather than depression (Mineka, Watson & Clark, 1998).

Similar biases in judgement have been found with performance tasks. For example, Wright and Mischel (1982) found that a sad mood induction task results in participants feeling less satisfied with their performance when compared to controls. However, the study can be criticised for not using clinical cases, and for a possible response-bias effect following the mood induction task (e.g., the participants may have been aware of the aim of the study and chosen the response option congruent to the mood induced).

The depressive realism theory holds the view that although depressed people perceive the world pessimistically, their judgements are more accurate than non-depressed people who view the world through "rose-tinted coloured glasses" i.e., in a positively distorted way (Alloy & Abramson, 1979). Alloy and Abramson (1979) looked at judgements of contingency in which they compared depressed and non-depressed

college students. They found that depressed individuals were more accurate at detecting a lack of contingency between a button-pressing response and a desired, positive outcome. Non-depressed participants were less accurate in judgement. If the outcomes were positive, the non-depressed participants over-estimated their control over the outcomes, and underestimated their control for negative outcomes. Similar results were also found for control over success on the button-pressing and outcome task (Alloy & Abramson, 1982), with depressed individuals being more accurate in judging non-contingency. However, the participants were not clinically depressed.

Although it is simplistic to state that depressed people are "sadder, but wiser" (Williams et al., 1997) in terms of being less biased in their judgement, it does have potential implications for clinical practice. The clinical implications would include increasing judgements of control over positive situations (Williams et al., 1997). However, studies that used clinically depressed individuals found that they tend to underestimate positive reinforcement (Salkovskis, 1996), which suggests that they do not see the world more accurately than non-depressed individuals. Therefore, although non-depressed individuals appear to have a slight bias towards perceiving the world in a positive light, when severely depressed, an individual tends to distort information negatively.

Several cognitive processes are involved in judgement. These include the selection and encoding of stimuli, the interpretation, storage and recall of the stimuli (Williams et al., 1997). Since mood can effect each of these stages, biases in judgement tend to occur when in an emotional state. This would be consistent with Beck's (1967, 1976), Bower's (1981) and Williams et al's. (1988, 1997) models.

In summary, individuals with emotional disorders appear to have biases in judgement, although these are less well researched than attentional and memory biases. It

is thought that these biases may serve to maintain negative mood states (Williams et al., 1997). Biases in judgement include biases towards negative contingencies and increased expectations of negative events occurring. In addition, there is also a tendency to interpret ambiguous information in a negative way. Interpretation biases of ambiguous information will now be discussed.

Interpretation: Methodological paradigms and empirical findings

Whilst there has been considerable support for cognitive biases in attention and memory in the emotional disorders, fewer studies have focused on interpretation of ambiguous information (MacLeod & Cohen, 1993). However, there is some overlap between research into judgement and interpretation (Williams et al., 1997). It has been suggested that an interpretative bias may have an important maintaining effect of mood in the emotional disorders. Making a negative or threatening interpretation of ambiguous information may increase worry and symptoms of depression (Mogg, Bradley, Millar, Potts, Glenwright & Kentish, 1994). To date, most research into interpretative bias has been carried out with anxious individuals.

Research examining interpretation bias has used different experimental paradigms (Calvo & Castillo, 1997). These include the homophone paradigm, the recognition paradigm, the lexical decision paradigm, ambiguous social scenarios and the reading time paradigm. These will be explored in turn.

Firstly, in the homophone task, words (that can be spelt in two ways e.g., die/dye, pain/pane) are read out in a list and participants are required to write them down. Although anxious individuals tend to write down the more negative interpretation of such words (Eysenck, MacLeod & Mathews, 1987; Mathews, Richards & Eysenck, 1989; Mogg et al., 1994) there is mixed evidence as to whether this is due to trait or state anxiety (Mogg et al., 1994). The homophone task has been criticised for response bias

effects (e.g., participants may select both meanings of the words but only have a bias in terms of response choice, rather then interpretation (MacLeod & Cohen, 1993)), and comorbidity of anxiety and depression, which may restrict the usefulness of such tasks (Mogg et al., 1994).

Secondly, the recognition paradigm involves an initial encoding task, in which participants are presented with an auditory list of ambiguous sentences. This is followed by a recognition task, which consists of a written list of threat and non-threat related unambiguous versions of the original sentences. Participants decide whether they have similar meanings to the auditory version. Eysenck, Mogg, May, Richards and Mathews (1991) used this method and found that anxious patients (who were high in trait and state anxiety) were more likely to 'recognise' the threat versions, which was consistent with an interpretative bias favouring threat. In addition, recovered anxious patients no longer showed an interpretative bias. However, the anxious patients were treated as one group, and specific individual anxieties were not accounted for (Eysenck et al., 1991).

Thirdly, Richards and French (1992) used homographs with threatening and non-threatening meanings (e.g., stroke) as primes in a lexical decision task. Anxious participants were quicker to respond to targets related to the threat meaning. However, these results were only found when there was a delay of over 750 ms between the prime and target word. This suggests that the interpretation bias may not be automatic, and may depend on slower strategic processes. It may also suggest that both meanings were attended to. In criticism of the study, it is not possible to say whether such effects are directly or indirectly due to anxiety levels. The effects between the anxious and control groups may have been due to an increased frequency of usage of the words (Richards & French, 1992). In addition, the study had a small sample size and did not use clinically anxious individuals. Generalisation from the results is, therefore, questionable.

Fourthly, Butler and Mathews (1983) gave depressed and anxious patients a series of ambiguous social scenarios to read, followed by an open-ended question regarding the ambiguous sentence. Participants were required to think of alternative responses to the question, and rank how likely they were to come to mind. They found that clinically depressed and anxious individuals tend to select the negative interpretations of ambiguous social scenarios. Similarly, MacLeod (1990) found that participants with high anxiety levels tend to interpret ambiguous prime sentences in a negative way. In this study, participants read an ambiguous prime sentence that allowed both a negative and neutral interpretation, before naming aloud a single target word. High anxiety participants were quicker at naming target words that were related to the negative meanings of the ambiguous primes. The results also show an exaggerated priming effect for participants who have a dysphoric mood state. However, the results may have been due to the individuals selecting the depressed or anxiety-related option, rather than interpreting the material this way (MacLeod & Cohen, 1993). If a response bias occurs, then actual interpretations may not be biased (Lawson & MacLeod, 1999).

To reduce these methodological difficulties, a fifth interpretation paradigm has been introduced: the reading paradigm (MacLeod & Cohen, 1993). The RSVP (Rapid Serial Visual Presentation) paradigm has been used, in which participants do not need to emit or endorse alternative response options. The RSVP task involves presenting participants with a reading task that is presented sentence by sentence. The participants are required to press a button to receive each sentence, and then answer a question about the sentences on a yes/no basis. The participants believe that their answer to the question is the data of interest. However, the critical data is measured by reading speed. Reading speed, or comprehension latency, has been inversely related to the degree in which the text follows from a previous sentence (MacLeod & Cohen, 1993).

Using this technique, MacLeod and Cohen (1993) looked at 80 ambiguous sentences that could be interpreted in a threatening or non-threatening way e.g., "The doctor examined little Emily's growth". Each ambiguous sentence was followed by a negative or neutral continuation sentence e.g., "Her tumour had changed little since last visit" or "Her growth had changed little since last visit". Comprehension latencies (i.e., reading times) of the continuation sentence are influenced by the meaning that the participant had placed on the original sentence. That is, continuation sentences that are consistent with the meaning placed on the preceding ambiguous sentence are read quicker than inconsistent sentences. On some trials, prime words were also used before each ambiguous sentence to help determine choice of interpretation e.g., "lump" or "tall". These provide useful comparison conditions, so that reading times for unconstrained ambiguous sentences can be compared with those from threat-primed and neutral-primed sentences. MacLeod and Cohen (1993) found that a group of high trait anxious students interpreted ambiguous information negatively, when compared to a control group and a 'recovered' group. However, the study can be criticised for using students rather than clinically anxious individuals. In addition, although trait anxiety was used as an independent variable, the groups differed on measures of state anxiety and depression. Interpretative biases may have been affected by these variables (MacLeod & Cohen, 1993).

Lawson and MacLeod (1999) adopted a similar strategy to MacLeod (1990) to determine whether an interpretation bias exists in individuals with non-clinical depression. A naming latency task with a priming methodology was used to reduce experimental bias. Participants were required to read ambiguous sentences that allowed a depressed-related or a non-depressed related interpretation. Each sentence was followed by a target word that was related to one interpretation of the ambiguous sentence. The

verbal naming latency of the target word was recorded. However, no evidence was found to support the existence of a negative interpretation bias in depression. They conclude that there is no tendency to interpret ambiguous material negatively. However, the study did not use a clinical sample. Instead they used students with a mean score of 12.38 on the Beck Depression Inventory (BDI), which indicates mild depression only. The researchers also used a mood induction procedure to induce dysphoria. The mood induction procedure may have resulted in experimenter demand, with the sad music and mood resulting in a possible response bias. An undiagnosed, dysphoric group with a low BDI score may not be representative of a depressed sample. How this compares to clinical levels of depressed mood is questionable.

Future research, therefore, requires a clinically depressed sample (Lawson & MacLeod, 1999) with a primary diagnosis of unipolar depression and needs to use methodologies that reduce experimental bias, such as the RSVP task. Sentences on the RSVP paradigm need to be tailored to depressed themes of loss, failure and rejection. Mood induction procedures should also not be used to help reduce possible experimenter demand effects.

In sum, when response bias effects have been removed, it appears that although a negative interpretative bias of ambiguous material exists in anxiety states, this may not occur in depressed states. The results of MacLeod and Cohen's (1993) and Lawson and MacLeod's (1999) studies (which aim to reduce response bias) provides some support to Williams et al's. (1988, 1997) theory, that patterns of cognitive biases in depression and anxiety may be different in nature. It also suggests possible limitations to Beck's (1967, 1976) and Bower's (1981) models, since they would predict no differences in information processing in depressed and anxious states.

Summary

Information processing research in emotional disorders has focused on four main areas: memory bias, attentional bias, judgement bias and interpretative bias. The literature has suggested some important differences in information processing in anxiety and depressed states, although some research findings have been mixed. This has provided some strength to Williams et al's. (1988, 1997) model, and pinpointed some limitations of Beck's (1967, 1976) and Bower's (1981) models. According to Williams et al. (1988, 1997) depressed individuals show information processing biases after stimulus identification has occurred and during elaborate processing (e.g., memory). Anxious individuals appear to have pre-conscious attentional biases to threat material. Research into interpretative bias has suggested that once response bias effects have been removed, there is evidence that anxious individuals interpret ambiguous information in a threatening manner. However, depressed individuals do not appear to interpret ambiguous material negatively. Furthermore, if depressed individuals do not tend to interpret ambiguous information negatively, and non-depressed individuals interpret material positively, this would raise questions about the accuracy of a depressed individual's judgement and interpretation and may give some insight into the depressive realism theory. If this did occur, there would, however, continue to be group differences in interpretative bias.

## Future research directions

There is a need to investigate further interpretation biases in patients with clinical depression, using more advanced experimental procedures e.g., the RSVP paradigm that helps to remove the effect of response bias. As this review paper has highlighted, there is a gap in our understanding of how ambiguous information is interpreted in clinical

depression. Although an interpretation bias of ambiguous information in anxiety states has been repeatedly found (e.g., MacLeod & Cohen, 1993), this was not replicated in students with mild induced-depressed states (Lawson & MacLeod, 1999). This has significant clinical implications for treatment for the emotional disorders, since it suggests that no negative interpretation is found in depressed states. This in itself is a challenge to cognitive therapy, that proposes challenging negative thoughts as one method of helping people with depression (Beck et al., 1979).

Firstly, studies could replicate the work of MacLeod and Cohen (1993) but use patients with a primary diagnosis of clinical depression as opposed to anxiety. Ambiguous sentences would need to be related to themes of depression e.g., loss, rejection, failure, worthlessness. In addition, anxiety would need to be measured, either by a diagnostic checklist, or by anxiety rating scales, to ensure that any significant results found are due to depression and not co-morbid anxiety. Using depressed patients would also remove the need to use a mood induction task.

Secondly, studies could replicate the work of Eysenck et al. (1987) to determine whether patients with a diagnosis of clinical depression interpret homophones in a negative way. This would involve using words that are related to the depressed themes of loss, failure and rejection e.g., berry/bury, teas/tease. Although the homophone task has been criticised for a possible response bias effect, using clinically depressed individuals will allow this interpretation bias to be studied in more detail and the results compared to the more sophisticated RSVP task.

Finally, if an interpretation bias is found, prospective studies could investigate whether an interpretation bias is a risk factor in the development and/or maintenance of depressive thinking styles. Longitudinal studies could also be used to determine whether

this type of information processing continues after a depressive episode has resolved, and whether an interpretation bias is a risk factor for relapse.

## Clinical implications

There are several clinical implications of this review paper, both in terms of information processing and emotion, and in terms of interpretation biases (specifically in depressed states). Firstly, in terms of information processing generally, if depressed individuals do not show a negative interpretative bias to ambiguous information and anxious individuals do, then this provides further support for Williams et al's. (1988, 1997) theory that argues that depression and anxiety have different patterns of cognitive bias. It also adds further limitations to Beck's (1967, 1976) and Bower's (1981) models, which assume that similar biases operate in these emotional disorders.

Secondly, in terms of depression, if future research shows that individuals with depression do interpret ambiguous information negatively, then treatments, such as cognitive-behavioural therapy will need to continue to address this by modifying negative appraisals and underlying beliefs. However, if future studies find that depressed individuals do not interpret ambiguous information negatively, then treatments that continue to modify thoughts and beliefs may not be appropriate. Instead intervention may need to focus on strategic aspects of negative memory e.g., memory, rather than an interpretation bias.

Thirdly, due to the high prevalence of depression in the population and risk of relapse, the burden of depression on health care is high. It is, therefore, pertinent to have a clear understanding of the illness, in terms of the cognitive variables that may be responsible for it's development and maintenance. Further research into information processing in emotional disorders will help to understand clinical mood disorders more

fully. Future research into interpretative biases in clinical depression will have clinical implications in terms of improving understanding of generation and maintenance of the disorder. As psychological treatments are based on formulations of the development and maintenance of distress, the results of such research will help to guide clinical practice.

Finally, information processing and cognitive biases may prove to be sensitive enough to be measured and correlated with mood change during treatment. However, research would first have to verify the validity and reliability of tasks such as the RSVP paradigm.

## Conclusion

Research into information processing biases in the emotional disorders has been fairly extensive and has focused on studies of attention, memory, judgement and interpretation to understand the similarities and differences in cognitive biases in depression and anxiety. This work has more recently extended to other clinical areas such as alcohol misuse (Johnsen et al., 1994), and bulimia (McManus et al., 1996). Research into information processing biases may increase our understanding of the development and maintenance of clinical disorders and help to develop effective treatment strategies.

This paper has brought together two areas of literature: information processing models of cognitive processing in depression and anxiety in general, and a focus on interpretation of material in depression. Three main models of information processing have been discussed. Beck's (1967, 1976) model proposes that cognitive biases in emotional disorders exist due to negative schemas. When in an emotional state information is distorted to fit with negative schema. He proposes similar cognitive biases in depressed and anxious states. Bower's (1981) model proposes that emotions are associated with the activation of emotional nodes in the memory system. This results in

enhanced memory, attention and perception of information consistent with an emotion. This model also proposes similarities in depressed and anxious states. Williams et al's. (1988, 1997) model looks at differences between depressed and anxious states and how information is processed. This model has suggested a strategic processing bias in depression and a pre-attentive bias in anxiety. With regards to the research literature, Beck's (1967, 1976), Bower's (1981) and Williams et al's. (1988, 1997) models have all been partially supported, although each model has limitations due to the mixed research findings. More research is needed before firm conclusions can be made regarding information processing and theoretical models.

This paper has explored biases in memory, attention, judgement and interpretation. It has highlighted the need for more research in the area of depression and interpretation of ambiguous information. Possible research directions to explore an interpretation bias for negative information in depression have been suggested. This would involve using patients with a diagnosis of clinical unipolar depression, and applying more sophisticated experimental designs. The clinical implications of a negative interpretation bias in clinical depression include addressing the cognitive interpretation of information via cognitive-behavioural strategies. However, if an interpretation bias does not exist in depression, then cognitive-behavioural strategies may need to be modified.

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# Does a negative interpretation bias exist in patients with clinical depression?

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Running head Interpretation biases in depression

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# Does a negative interpretative bias exist in patients with clinical depression?

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## Abstract

Beck's (1967, 1976) cognitive model predicts that individuals vulnerable to depression should favour negative interpretations of ambiguity. The current study tested the hypothesis that individuals with a diagnosis of clinical depression will demonstrate negative interpretative biases to ambiguous information. Previous studies have found that individuals with depression have a negative bias in interpretation (Butler & Mathews, 1983; Cane & Gotlib, 1985). However, it has been suggested that these results may be due to experimenter demand or an emotionally linked response bias effect.

The present study examines patterns of interpretative processing shown in individuals with a primary diagnosis of clinical depression (n = 24) on a homophone task and on a reading task (that removes response bias). Negative memory biases are also investigated. Results show that in comparison with non-depressed controls, clinically depressed individuals impose negative interpretations on the homophone task but not on the reading task. In addition, the depressed group showed a memory bias favouring negative information, compared with the control group. The theoretical implications of these findings are discussed, together with suggestions for future research.

# Does a negative interpretative bias exist in patients with clinical depression?

## Introduction

Individuals who experience clinical states of depression and anxiety have specific patterns of biases in processing emotional information. This can result in cognitive biases in attention, memory and interpretation that favour negative information (Williams, Watts, MacLeod & Mathews, 1997). Several theories suggest that cognitive biases may play an important role in causing and maintaining clinical depression (Beck, 1967, 1976; Williams et al., 1988, 1997).

Beck's (1967, 1976) schema model suggests that information processing biases occur as a result of negative schemas. Schemas are stable cognitive patterns that develop during childhood, and are used to understand, evaluate and structure the self, the world and the future. Schemas can be inactive for a while, but can be triggered by specific events. Since people perceive experiences in ways dependent on their schemas, information can be distorted. Depressed individuals tend to develop schemas associated with negative views of the self, the world and the future. Anxious individuals develop schemas associated with threat and danger (Beck, Rush, Shaw & Emery, 1979). Beck's (1967, 1976) model suggests that individuals who experience episodes of depression will selectively attend to negative information, have a facilitated memory for negative information and have an interpretation bias towards the more negative meanings. Similar biases are presumed to operate in anxiety for threatening information.

Alternatively, Bower's (1981) network model suggests that information processing biases occur in emotional disorders due to the relationship between mood and memory. He proposes that concepts and events are represented as nodes in the memory

network, with each emotion having a particular node. Therefore, when an individual is depressed, there is an increase in the activation of the associated concept or event nodes, resulting in negative cognitive biases. Teasdale's (1983) 'differential activation hypothesis' model integrates the schema and network model, and suggests that vulnerability to ongoing depression is determined by the accessibility of cognitions once an individual initially becomes depressed.

However, research has shown that there are differences in information processing in individuals with depression and anxiety (Williams et al., 1988, 1997). These differences are not predicted by Beck's (1967, 1976) or Bower's (1981) models and highlight some of their limitations. Williams et al. (1988, 1997) developed an information processing model to help understand cognitive differences in depressed and anxious states. Williams et al. (1988, 1997) suggest that depression influences information processing when stimulus identification and elaborate processing occurs (i.e., when further processing of the relationship between the stimuli and context occurs). This results in biases in memory for negative information. This does not occur in anxiety. Instead, anxious individuals appear to have attentional, rather than memory biases, to threat related material (MacLeod & Mathews, 1988; MacLeod, Mathews & Tata, 1986; Mogg, Mathews & Weinman, 1987). This attentional bias in anxiety is thought to occur at a pre-attentive stage and involves automatic processing (Williams et al., 1988, 1997). Drawing on the information processing model, negative interpretation biases may also depend on whether information has been processed strategically or automatically. A negative interpretation bias may only be found to occur in depression if information has been elaborately processed, and in anxiety if automatic processing of threatening information occurs (Williams et al., 1988, 1997).

Cognitive differences in depression and anxiety highlight the importance of studying information processing models (and to control for the different mood states) to understand the development and maintenance of emotional disorders. Since psychological treatments are based on this understanding, such models will help to provide clinically effective interventions.

To date, most research in depression has focused on attention and memory biases, with less focus on interpretation biases (MacLeod & Cohen, 1993). On the other hand, substantial research has looked at interpretation biases in anxiety (Eysenck, MacLeod & Mathews, 1987; Mathews, Richards & Eysenck, 1989; Eysenck, Mogg, May, Richards & Mathews, 1991; Mogg, Bradley, Millar, Potts, Glenwright & Kentish, 1994). The research that has examined interpretation biases in depression has produced mixed findings. Butler and Mathews (1983) gave depressed patients a series of ambiguous social scenarios to read. This was followed by an open-ended question regarding the ambiguous sentence. They found that depressed patients interpret ambiguous social scenarios in a negative manner when compared to non-depressed controls. Similar findings using ambiguous scenarios were also found by Miller and Norman (1986). In addition, Cane and Gotlib (1985) found that clinically depressed participants with high depression scores interpret their social performance negatively when using an evaluative feedback form. Similarly, although using non-clinical cases, Wright and Mischel (1982) found that a sad mood induction task (prior to a cognitive task) resulted in participants negatively interpreting and feeling less satisfied with their performance when compared to controls.

The research examining interpretation biases has highlighted methodological difficulties. Consequently, it has been difficult to determine whether differences in interpretation are due to a cognitive bias or methodological variables (MacLeod & Cohen, 1993). One potential problem is response bias i.e., participants may select both the

negative and positive interpretations but only have a bias in terms of their response choice, rather than interpretation (MacLeod & Cohen, 1993). For example, Eysenck et al. (1987) presented anxious individuals with a list of homophones (words with two alternative meanings that differ in emotional valence e.g., die/dye, pain/pane) and found that anxious individuals are more likely to write down the negative interpretation. However, an emotionally linked response bias may have occurred, as both meanings of the words may have been considered, and only the negative words written down (MacLeod & Cohen, 1993). A second potential problem is experimenter demand effects. This may occur if the participant becomes aware of the purpose of the study and select the response option that they feel is required of them.

Alternative findings for a negative interpretation bias in depression were found by Lawson and MacLeod's (1999) study. The study attempted to reduce response bias effects by measuring the critical response without the participant's awareness. They examined a negative interpretative bias for ambiguous information in non-clinical depressed states. In this study, participants were required to read ambiguous sentences that could be interpreted in either a depressed or non-depressed way. Each ambiguous sentence was followed by a naming latency task in which participants had to read aloud a target word that was related to one interpretation of the ambiguous sentence. However, no evidence was found to support the existence of a negative interpretation bias in depression. They conclude that although depression is associated with a negative interpretative bias in some studies (e.g., Butler & Mathews, 1983), this may be due to response bias and that there is no tendency to interpret ambiguous material negatively when response bias is removed. However, the study used students with mild depression rather then a clinical sample. Experimental demand may also have occurred in Lawson and MacLeod's (1999) study since the researchers used a mood induction procedure to induce dysphoria. The

participants may have guessed the purpose of the study and completed the task in a way which they thought was required i.e., in a 'depressed' way.

Since the few studies that have explored interpretation biases in depression have had varied outcomes, the present study attempts to examine interpretation of ambiguous material in clinically depressed individuals. In order to overcome the methodological difficulties described in these earlier studies (experimenter demand and response bias effects) the present study uses an RSVP (Rapid Serial Visual Presentation) paradigm adopted by MacLeod and Cohen (1993). In this paradigm, participants are not required to emit or endorse any alternative response options and the critical measure is taken without the participant's awareness. The RSVP paradigm involves a reading task in which sets of sentences are presented sentence by sentence. Each set of sentences consists of an ambiguous sentence followed by a continuation sentence. Participants are required to press a button to receive each ambiguous sentence, and continuation sentence and then answer a question about the sentences on a yes/no basis. The critical measure is reading speed, rather then the answer to the question. Reading speed (or comprehension latency) has been inversely related to the degree to which the text follows from a previous sentence (MacLeod & Cohen, 1993).

MacLeod and Cohen (1993) used the RSVP paradigm to examine response to 80 ambiguous sentences in individuals with anxiety. They found that high trait anxious students interpreted ambiguous information negatively, when compared to a control group and a group that are no longer anxious.

The present study uses the RSVP paradigm with 80 ambiguous sentences that can be interpreted in a depressed or non-depressed way e.g., "Lisa asked her father not to put her down." Each ambiguous sentence is followed by a depressed or non-depressed continuation sentence e.g., "She preferred it when he praised her" (depressed

continuation) or "She preferred it when he carried her" (non-depressed continuation). Comprehension latencies are influenced by the meaning that the participant places on the original sentence. Continuation sentences that are consistent with the original meaning placed on the preceding ambiguous sentence are read quicker than inconsistent sentences. On half the trials the ambiguous sentences are preceded by a string of question marks (?????), indicating the ambiguous (no cue) condition. On the other half of the trials, the interpretation of the ambiguous sentence is experimentally determined by a cue word shown immediately before the ambiguous sentence. These cue words are either depressed-related (e.g., criticism) or non-depressed related (e.g., piggy-back) and participants are asked to use this word as a context when reading the following (ambiguous) sentence. These conditions allow within subject comparisons of the effect of ambiguous and unambiguous interpretations on the reading time of the continuation sentences.

The first aim of the study is to determine whether individuals with a diagnosis of unipolar depression interpret ambiguous information negatively using a RSVP reading task. Drawing upon Beck's (1967, 1976) and Bower's (1981) cognitive model we would predict that depressed individuals interpret ambiguous information negatively. Williams et al's. (1988, 1997) model would suggest a possible negative interpretation bias in depressed individuals only if strategic processing occurs as opposed to automatic priming. If a person interprets the ambiguous sentences in a negative fashion, the depressed cue and no cue conditions should have a similar effect on reading times for the continuation sentences.

Specifically, if a person has a negative interpretative bias, their reading times for depressed continuation sentences should be similar in the depressed cue and no cue conditions, with both these conditions being faster than the non-depressed cue condition

(i.e., the ambiguous cue has a similar effect to an unambiguous depressed cue). In addition, for the non-depressed continuation sentences, the depressed cue and no cue conditions should have a similar effect, with reading times being slower for both these conditions compared with the non-depressed cues. We predicted that the depressed group would show a negative interpretative bias, which should be evident from the pattern of reading times as described above.

The second aim of the present study is to determine whether a negative interpretative bias exists in clinical depression when using a homophone task (Mathews et al., 1989). Again, Beck's (1967, 1976) and Bower's (1981) cognitive models predict a negative interpretative bias. Williams et al's. (1988, 1997) model also suggests a possible negative interpretative bias in depression if elaborate processing occurs. It is hypothesised that the depressed group will interpret more negative meanings to the words than the control group. This interpretative task has been widely used to study interpretative biases in anxiety (e.g., Mathews et al., 1989), but there have been no published studies using it to study interpretative bias in depressed individuals. The findings can also be compared to those from the RSVP task, although the homophone task has the disadvantage of being more prone to potential response bias effects.

The third aim of the present study was to replicate Bradley and Mathews' (1983) study to show that a negative memory bias occurs in clinical depression. Williams et al's. (1988, 1997), Beck's (1967, 1976) and Bower's (1981) cognitive models predict a negative memory bias in depressed individuals. It is therefore hypothesised that the depressed group will describe themselves more negatively and recall more negative self-descriptive words than the controls. This task is included in the study since the literature has already established a negative memory bias in depression (Bradley & Mathews, 1983)

and so the results can be used to check that the current sample exhibit typical cognitive biases characteristic of clinically depressed individuals.

## Method

*Design*

The study uses a mixed between and within subject design to test the hypotheses for the interpretative bias tasks. For the dependent variable (reading time) in the RSVP task there was one between subject variable of group (depressed individuals versus non-depressed controls). There were two within subject variables which were cue condition (depressed, non-depressed and no cue) and continuation (depressed and non-depressed). For the dependent variable (percentage of negative interpretations) in the homophone task there was one between subject variable of group (depressed individuals versus non-depressed controls), and one within subject variable which was valence of the words (negative versus neutral). For the dependent variable (number of negative self-rated words recalled) in the memory task there was one between subject variable of group (depressed individuals versus non-depressed controls), and one within subject variable which was valence of the words (negative versus neutral).

*Participants*

Forty-eight people participated in the study. Twenty-four were clinically depressed and 24 were non-depressed controls. The clinically depressed participants were recruited from an out-patient service, via psychiatrists, clinical psychologists and nurse therapists. The clinical group consisted of seven men and 17 women, aged between 33 and 59 years (mean age = 45.33 years, SD = 7.16). All clinical participants had a primary diagnosis of unipolar depression, a score of over 22 (moderately to severely depressed) on

the Beck Depression Inventory II (BDI-II; Beck 1996; see Appendix 3), and fulfilled the Diagnostic and Statistical Manual of Mental Disorders (fourth edition) criteria for unipolar depression (DSM-IV; American Psychiatric Association, 1994).

The 24 non-depressed control participants consisted of seven males and 17 females, aged between 27 and 55 years of age (mean age = 41.96 years, SD = 9.25). They were matched with the clinical group on age, gender and number of years in education. The control group had no known history of depression that required treatment, and had a current BDI-II score of below 10 (minimal depression). The control group consisted of hospital employees, friends, family and neighbours. Each participant spoke English as a first language.

*Materials*

*Questionnaires.* Measures of depression were taken from the BDI-II and a DSM-IV diagnostic based questionnaire for mood disorders (see Appendix 4) to ensure they fulfilled the criteria for unipolar depression. A more detailed assessment was not used due to time limitations. Anxiety levels were measured by the Beck Anxiety Inventory (BAI; Beck & Steer, 1993; see Appendix 5). A DSM-IV diagnostic-based questionnaire for anxiety disorders (see Appendix 6) was also given. This attempted to include diagnostic criteria for anxiety disorders to control for other diagnoses that could explain the results.

*Information Form.* Two information forms were devised, one for the clinical group (see Appendix 7) to find out details of their depression, and one for the control group (see Appendix 8) to ensure there was no history of depression. The clinical group were required to give information on the length of their illness, past episodes of depression and current and past treatment. The control group were required to answer

questions on whether they had ever received treatment for depression or any other psychiatric illnesses.

*The Reading Task*

*Stimulus sentence sets.* The main interpretative task was conducted via a lap-top computer (MEL 2 software; Schneider, 1995), and was based on MacLeod and Cohen's (1993) study. The task involved participants reading 80 ambiguous sentence sets. These sentences were taken from MacLeod and Cohen's (1993) and Lawson and MacLeod's (1999) studies and also devised by the author. Each sentence set included an ambiguous sentence that had one negative meaning and one non-depressed meaning. The negative meanings were based on depressed-related themes of loss, failure and rejection e.g., "Lisa asked her father not to put her down" and "Many people had tears in their eyes during the afternoon service." Face validity was tested by expert review; the sentences were given to five clinical psychologists and a psychiatrist to ensure that the content was depressed-related (see Appendix 9 for the sentence sets).

Each sentence set also contained two alternative continuation sentences that followed from the first ambiguous sentence. This was randomly either a non-depressed continuation or a depressed-related continuation sentence. For example, two possible continuation sentences for the ambiguous sentence "Lisa asked her father not to put her down" were "She preferred it when he praised her" (depressed continuation) and "She preferred it when he carried her" (non-depressed continuation).

Three different cue conditions were also prepared for each sentence set. One of the three cue conditions was randomly selected for presentation before the ambiguous sentence. One cue word was related closely to the depressed continuation sentence e.g., "criticise" (depressed cue), one cue word closely related to the non-depressed continuation e.g., "piggy-back" (non-depressed cue) and the third cue condition was a

string of question marks which was used as an ambiguous cue i.e., "?????" Finally, each sentence set ended with a question that related to the ambiguous sentence e.g., "Did Lisa ask her father not to put her down?" Forty of the questions had a correct answer of "yes" and 40 "no".

The 80 sets of sentences were randomly presented. The cue condition and the type of continuation sentence were randomly selected for each trial, within the constraint that each participant received 20 ambiguous cues with non-depressed continuations (AN); 20 ambiguous cues with depressed-related continuations (AD); 10 depressed-related cues with non-depressed continuations (DN); 10 depressed-related cues with depressed-related continuations (DD); 10 non-depressed cues with non-depressed continuations (NN) and 10 non-depressed cues with depressed-related continuation (ND).

*Homophone Task*

The homophone task was based on Mathews et al's. (1989) study. Twenty-eight words were auditorily presented using tape-recorded lists to ensure standardised presentation conditions. The words were taken from Mathews et al. (1989) and consisted of 14 homophone words e.g., die/dye, tease/teas and 14 neutral words e.g., rake, melon (see Appendix 10 for the list of words and Appendix 11 for the response sheet).

*Memory Task*

The memory task was based on Bradley and Mathews' (1983) study. Participants were required to listen to 26 words auditorily presented using tape-recorded lists, and circle yes/no on a response sheet if the word currently describes them (see Appendix 12). The critical stimuli consisted of 10 positive words and 10 negative words (see Appendix 13). The positive and negative words were matched on word length and frequency

(Carroll, Davies & Rickman, 1971). In addition, the first and last three words on the list were neutral words, and were included to control for the primacy and recency effect (Baddeley, 1986). These words were not included in the analysis.

*Pilot Study*

The study was piloted on six non-depressed and one depressed participant to ensure that there were no difficulties with the methodology. No changes were made.

*Procedure*

Following ethical approval (see Appendix 14 and 15 for letters of ethical approval), the consultant psychiatrists and clinical psychologists working within the service were contacted. They were asked whether they would be willing to provide names of potential depressed participants for the research study (see Appendix 16 for a copy of the letter). This initial contact resulted in 57 names. An information sheet (see Appendix 17) and consent form (see Appendix 18) were sent to each individual. Twenty-nine individuals responded to the letter. They were then contacted and an appointment made. Of these, four did not attend and one did not reach the diagnostic criteria for depression.

At the start of the test session, participants were informed that they could withdraw at any time, and were given the opportunity to ask questions about the research. All participants were seated in a comfortable room, free from interruption. They were required to give their age and number of years in full-time education. For the reading task, participants were told that a number of sentences would be presented via a computer screen, and that they had to answer a simple question at the end of each set of sentences. They were told that their answer to the questions was the data of importance. This was done to reduce experimental bias.

Each participant was provided with a response box (MEL 2 software; Schneider, 1995) that contained three buttons. The button on the right was labelled 'N' (indicating 'next') and was pressed to control the presentation of stimuli. The button on the left was labelled 'Yes' and the middle button 'No'. All sentences were presented in the middle of the computer screen. Each of the 80 trials began with the words "Next Trial" and remained on the screen until the 'N' button was pressed. The screen then presented "The cue word is..." with the randomised cue word presented below (depressed, non-depressed or ambiguous). Participants were instructed to use the cue to anticipate the meaning of the following sentence. The cue word remained until the button labelled 'N' was pressed to reveal the ambiguous sentence. The participant was asked to read the sentence and press 'N' to continue. The randomised continuation sentence (depressed or non-depressed) was then presented. The participants were asked to read this second sentence and press the 'N' button when the sentence was read. A question about the set of sentences was then presented and answered by pressing the 'yes/no' button accordingly. This was followed by the 'next trial' display and the next sentence set commenced. The procedure allowed eight practice trials followed by 80 experimental trials. The computer software calculated reading times for each sentence set as the time (in milliseconds) between the button press that revealed the continuation sentence, and the button press that removed the sentence from the screen for each trial. This speed was measured and interpreted as comprehension latency.

The main reading task was followed by the homophone task. Twenty-eight words were presented auditorily via a dictaphone. Participants were asked to listen to each word and write it down on a response sheet. A five-second delay was given between each word. The 14 homophone words and 14 neutral words were given in a fixed, randomised order for each participant.

Thirdly, the participants were asked to listen to 26 words presented auditorily via a dictaphone, and circle yes/no on a response sheet if the word currently described them. The positive and negative words were randomised and given in a fixed order for all participants. After the words had been presented, participants were given a response sheet and asked to recall as many of the words as they could in two minutes. They were not informed previously that this would be a memory task.

Following the experimental tasks the participants were given the BDI-II and BAI. These were completed after the main tasks so not to bias the results of the tasks. The control group were asked four questions to ensure that they had not been treated for depression in the past. The clinical group answered questions regarding past and present treatment, and gave a history of their depression. In addition, a diagnostic interview was completed to ensure they fulfilled the DSM-IV criteria for unipolar depression. A DSM-IV diagnostic anxiety-based questionnaire was then given.

Participants were thanked for their time and asked whether they would like to receive a copy of the results.

*Data Analysis*

Kolmogorov-Smirnov tests were used to test the normality of the distributions of the two groups' results in order to determine whether parametric or non-parametric statistics could be used. The reading task was analysed using parametric statistics using ANOVAs and t-tests. The mean reading times for each sentence type was calculated and compared between and within-groups. The mean number of negative interpretations of ambiguous words on the homophone task was analysed using parametric t-tests. The mean number of negative self-rated words and negative words recalled on the memory task were analysed using ANOVAs and t-tests. ANOVAs and t-tests were also used to

examine recall intrusions. When group differences were significant ANCOVAs of bias scores were used to statistically remove the effect of anxiety. Two-tailed tests were used throughout.

## Results

*Group Characteristic*

Using the DSM-IV diagnostic criteria for major depressive disorder and anxiety, all 24 participants in the depressed group met the criteria for major depressive disorder. Twenty also met the criteria for dysthymic disorder and 15 met the diagnostic criteria for one or more anxiety disorders (10 had social phobia, seven had generalised anxiety disorder, four had post-traumatic stress disorder, four had panic disorder, three had agoraphobia and one had claustrophobia). The mean number of concurrent anxiety diagnoses in the depressed group was 1.21 (range 0-5). Two depressed participants had self-reported concurrent psychiatric diagnoses (one had an eating disorder and one had a personality disorder).

In the depressed group, all were currently receiving medication for the treatment of their depression. Ten were receiving cognitive therapy and seven were receiving other therapy (e.g., counselling). In terms of past treatment, 20 had received medication, two had received cognitive therapy and 12 had received other treatment (e.g., counselling).

Group characteristics are summarised in Table 1. Kolomogorov-Smirnov tests showed that distributions of the questionnaire measures did not differ significantly from normality. Equality of variance was also checked. Therefore, parametric tests were used. T-tests showed that the depressed and control groups did not differ significantly in age ($t(46) = 1.41$, $p = 0.16$) or number of years in education ($t(46) = 1.28$, $p = 0.21$). Neither

did they differ significantly on gender ratio ($x2 = 0.10$, df = 1, $p > 0.20$). The two groups did differ significantly in depression measures (BDI-II scores) ($t(46) = 14.86$, $p < 0.001$) and anxiety measures (BAI scores) ($t(46) = 9.08$, $p < 0.001$), with the depressed group having significantly higher depression and anxiety scores.

Insert Table 1 about here

*Recall Bias Data*

The mean number of positive and negative self-rated words, the mean number of positive and negative words recalled and the number of intrusions (i.e., words written down that were not in the original list of words) for each group were calculated, and the means (and standard deviations) shown in Table 2.

Insert Table 2 about here

*Self-rated words.* A 2 x 2 mixed design analysis of variance (ANOVA) of the valence of self-rated words was carried out, with one between subject variable of group (depressed vs control) and one repeated measure variable of word valence (positive vs negative). Results showed no overall group difference in number of self-rated words ($F(1, 46) = 0.6$, $p = 0.44$). However, there was a significant interaction of group x valence ($F(1, 46) = 234.05$, $p < 0.001$). To clarify the group x valence interaction unrelated t-tests compared the number of positive and negative self-rated words in the depressed group and control group. Results showed significant differences in the number of negative and positive self-ratings between the depressed and the control groups. The depressed group rated significantly more negative words as self descriptive ($t(46) = 12.44$, $p < 0.001$) and

significantly less positive words as self descriptive ($t(46) = 13.37$, $p < 0.001$) than the control group.

*Words recalled.* A 2 x 2 mixed design analysis of variance (ANOVA) of the number of words recalled was carried out, with one between subject variable of group (depressed vs control) and one repeated measure variable of word valence (positive vs negative). Results showed no overall group difference in number of words recalled ($F(1, 46) = 2.36$, $p = 0.13$). However, there was a significant interaction of group x valence ($F(1, 46) = 20.99$, $p < 0.001$). To clarify the group x valence interaction related t-tests compared the number of positive and negative words recalled in the depressed and control groups separately. Results showed that the depressed group differed significantly on the number of negative and positive words recalled ($t(23) = 3.58$, $p < 0.01$), with more negative words recalled. The control group also differed on the number of positive and negative words recalled ($t(23) = 2.87$, $p < 0.01$), with more positive words recalled. When the depressed and control groups were compared using unrelated t-tests, there was a significant difference in the number of positive words recalled ($t(46) = 45.05$, $p < 0.001$), with the depressed group recalling less positive words, but no significant difference in the number of negative words recalled ($t(46) = 1.71$, $p = 0.10$).

An analysis of co-variance (ANCOVA) was used to determine whether a negative recall bias remained when the effect of anxiety (from scores on the BAI) was statistically removed. A recall bias score was calculated by dividing the number of negative words recalled by the total number of words recalled. A significant main effect of group on the negative recall bias score was found after controlling the effect of BAI scores ($F(1, 47) = 8.86$, $p < 0.005$), indicating that a negative recall bias remains when the effects of anxiety are removed.

*Recall intrusions.* A 2 x 2 mixed design ANOVA of intrusion was carried out with one between subject variable of group (depressed vs control) and a repeated measure variable of word type (positive vs negative). Results showed no significant main effect of group ($F(1, 46) = 0.08$, $p = 0.77$) or valence of the intrusions ($F(1, 46) = 2.09$, $p = 0.16$). There was also no significant interaction of group x valence of intrusion ($F(1, 46) = 2.09$, $p = 0.16$), which suggested no evidence of a significant response bias in the depressed group.

*Homophone Data*

The number of spellings corresponding to the negative interpretations of each homophone was calculated for each participant, and converted into a percentage of all homophones that were spelt correctly. The few spellings that did not correspond to either meaning were eliminated from the total. The depressed group had a mean negative interpretation bias score of 80.88% and the control group a mean negative interpretation bias score of 63.26%. A t-test showed that these means were significantly different ($t(46) = 5.73$, $p < 0.001$). Although both groups had means above 50%, indicating that a negative interpretation was dominant, the depressed group had a significantly higher negative interpretation bias.

An ANCOVA of bias scores was used to determine whether these results remained when the effect of anxiety was statistically removed. The effect of group on bias scores continued to be significant after controlling for the effect of BAI scores ($F(1, 47) = 14.18$, $p < 0.001$), suggesting that an interpretative bias exists in depression, independent of anxiety.

*The Reading Task*

The experimental software recorded the comprehension latencies on the sentences. This was calculated as the time between the onset of the continuation sentence and the button press that removed the continuation sentence from the screen for each trial. One participant from the depressed group was removed from the analysis since they had a poor accuracy score on the reading task (less than 70% of the answers were correct). This suggested that they were not attending to the task and so their answers were unlikely to be a valid measure of comprehension latency. When this participant was removed from the data, the depressed and control groups did not differ significantly in accuracy ($t(45) = 1.88$, ns). The percentage of questions answered correctly was 91% for the depressed group and 94% for the control group.

Box plots were used to identify outliers, and reading times of less than 200 ms or more than 10 seconds, and then those more than 3 standard deviations above the mean were excluded. The proportion of data lost was 2% in each group.

There were six different trials within the reading task: depressed cue, depressed continuation (DD), no cue (ambiguous), depressed continuation (AD), non-depressed cue, depressed continuation (ND), depressed cue, non-depressed continuation (DN), no cue (ambiguous), non-depressed continuation (AN), and non-depressed cue, non-depressed continuation (NN). Figure 1 shows the hypothesised reading patterns for each group.

Insert Figure 1 about here

A 2 x 2 x 3 mixed design ANOVA of reading times for the six trials was carried out, with one between subject variable of group (depressed vs. control), two repeated measures variables of continuation condition (depressed vs. non-depressed continuation)

and one repeated measure of cue condition (depressed cue vs. non-depressed cue vs. no cue). Table 3 and Figure 2 show the mean reading times for the six trials.

Insert Table 3 about here

The results showed a significant main effect of group ($F(1,45) = 4.55$, $p < 0.05$) with the depressed group having slower reading times than the control group. There was no significant main effect of 'continuation' or 'cue' ($F$s <1). There was a significant interaction effect of 'continuation by cue' ($F(2, 90) = 8.77$, $p < 0.001$), that was not affected by group ($F<1$).

Insert Figure 2 about here

To clarify the continuation x cue interaction, separate analyses were carried out for each continuation type.

*Depressed continuations.* For the depressed continuations, there was a significant main effect of cue ($F(2, 90) = 3.01$, $p < 0.05$) that was unaffected by group ($F(2, 90) = 1.90$, $p = 0.16$). T-tests showed that reading times were faster when the cue word was depressed-related (2797 ms) rather than non-depressed-related (2956 ms) ($t(46) = 2.18$, $p < 0.05$). The ambiguous cue condition was not significantly different from either of the other two cues ($t$s(46) <1.5, $p$s < 0.15).

*Non-depressed continuations.* For the non-depressed continuations there was a significant main effect of cue ($F(2,90) = 7.81$, $p < 0.001$) that was unaffected by the group($F<1$). T-tests showed that reading times were faster when the cue word was non-depressed (2759 ms) rather than depressed relevant (2979 ms) ($t(46) = 3.61$, $p < 0.01$).

Reading times were also faster when the cue word was ambiguous (2824 ms) rather than depressed relevant ($t(46) = 2.78$, $p < 0.005$). However, reading times for the ambiguous cue condition were not significantly different from those for the non-depressed cue condition ($t(46) = 1.49$, $p = 0.14$).

## Discussion

The results have shown negative information processing biases in the memory task and the homophone task. However, the RSVP paradigm used in this study has not revealed a negative interpretative bias on ambiguous sentences when using patients with clinical depression. The results will be discussed separately in terms of the memory task, the homophone task and the reading task.

*The memory task*

A recall bias for negative self-referent information has already been established in the literature and the main reason for including the task here was to ensure that the depressed group showed characteristic patterns of cognitive bias. Thus if non-significant results were obtained on the other tasks, it could not simply be attributed to inappropriate or unrepresentative participant samples. The current study examined the number of positive and negative words recalled in the memory task. As expected the results of Bradley and Mathews (1983) were replicated. The present sample, therefore, exhibit some of the memory biases that have been established in the literature. As predicted depressed individuals described themselves more negatively than non-depressed controls. The depressed group also recalled significantly more negative words than positive words, whereas the control group recalled more positive words than negative words. However,

although there was a group x valence interaction, the results showed no significant difference in the number of negative words recalled between the depressed and control group. This may suggest that the non-depressed controls have a bias in recall of positive material rather than the depressed group having a bias in recall of negative material. To confirm this, the study would need to include neutral words for comparison with positive recall, since the non-depressed group may not have a positive memory bias, but may have a deficit in recall of negative words. However, what is most important in the findings is the relative amount of positive versus negative words recalled, not the absolute amount of each type recalled.

The results also showed no significant difference in the type of intrusion given. This suggests that differences in the valence of word recall is attributed to memory as opposed to a response bias. If depressed individuals had a negative response bias, this should have been evident in terms of them having more negative intrusions.

In terms of the cognitive models, the results of the memory task confirm predictions made by Beck (1967, 1976), Bower (1981) and Williams et al. (1988, 1997), and most importantly, indicate that the design of the present study is sensitive to depression-related biases operating in memory. However, it is acknowledged that the use of neutral words would have been more informative. Beck (1967, 1976) and Bower (1981) predict that depressed individuals show a negative memory bias for information due to the activation of negative schema. Williams et al. (1988, 1997) suggest that depression influences information processing only after stimulus identification and elaborate processing occurs and, therefore, predict that depressed individuals have negative biases in memory.

*The homophone task*

These results confirm the hypothesis that depressed individuals interpret more negative meanings to ambiguous words than the control group. Although similar findings have been found for anxious individuals (Eysenck et al., 1987; Mathews, et al., 1989; Mogg et al., 1994), this is the first time that the homophone task has been used with clinically depressed individuals. These results are consistent with Beck's (1967, 1976) and Bower's (1981) models. However, Williams et al's. (1988, 1997) cognitive model suggests that a negative interpretative bias may occur in depressed states only if elaborate processing of information occurs. Since the homophone task is assumed to involve automatic processing, Williams et al. (1988, 1997) may not have predicted a negative interpretative bias on this task in depressed individuals.

However, the results from the homophone task may be due to response bias rather than an interpretative bias since both meanings could have been considered, and only the negative option reported (MacLeod & Cohen, 1993). It is difficult to determine, therefore, whether the findings are due to an interpretation bias or a response bias. According to Beck's (1967, 1976) model, we would predict that the findings are from an interpretation bias due to the negative schemas that it activates.

The homophone task can be criticised for several reasons. Although most words were depressed-related (e.g., loss, failure, rejection), some were not. For example pain/pane, flu/flew and weak/week may be more appropriate for anxiety-related themes of threat rather than depressed-related themes. In addition, words were only included in the analysis if they were spelt correctly. Since spelling ability was not directly controlled for in the study, it is difficult to safely say how the words were interpreted. For example, some people may have had both meanings come to mind and then write down the one they could spell more easily. This could be improved in future studies by asking each

participant to give the meaning of the word in relation to a sentence to help understand interpretation. In addition, participants may have selected the word that they were more familiar with. This could have been improved by matching both interpretations of the homophones on word frequency.

The reading task was used to determine whether an interpretation bias remains when using alternative measures that remove a possible response bias.

*The reading task*

The hypotheses for the reading task were not supported. No significant interactions were found involving group. However, the failure to find group effects does not seem to be due to the task being insensitive as there was a significant interaction effect due to the cue and continuation conditions. In the depressed continuation sentences, the participants (in the sample as a whole) were significantly quicker at reading sentences with a depressed cue, and slower at sentences with a non-depressed cue. However, since the ambiguous cue was not significantly different to either the depressed cue or non-depressed cue in terms of reading speed, this suggests that the ambiguous cue was not interpreted in a consistently negative or positive way. For non-depressed continuation sentences, reading times were faster when the cue word was non-depressed rather than depressed, which again is consistent with expectation (i.e., reading times depend on the interpretation imposed on the initial ambiguous sentence by the cue). Interestingly, reading times for the no cue (ambiguous) condition were similar to non-depressed cues, and faster than depressed cues for the non-depressed continuations. This suggests that participants processed ambiguous cues in a similar way to non-depressed cues (i.e., a non-depressed interpretative bias). However, this pattern of results was unaffected by the groups.

The results, therefore, suggest that once a more sophisticated experimental design is used to reduce response bias effects, a negative interpretative bias no longer appears to exist in the depressed group. The results of this study support the findings of Lawson and MacLeod (1999) since they found no evidence of a negative interpretative bias in depressed students. This also provides some evidence for Williams et al's. (1988, 1997) model since there appears to be a difference in the way in which anxious and depressed individuals process information. Anxious individuals appear to have a bias towards interpreting ambiguous material in a threatening way (MacLeod & Cohen, 1993), whereas no negative interpretative bias appears to occur in depression when response bias effects are removed.

The results of the interpretative tasks point to two possible conclusions. Firstly, that there is no interpretative bias in depression and that the results from the homophone task are due to response bias effects only. This would support Williams et al's. (1988, 1997) model that there is no automatic activation of negative information in depression, although this does occur in anxiety states. Beck's (1967, 1976) and Bower's (1981) models would not be supported since they conclude that automatic processing of negative information does occur in depression.

Secondly, there is an interpretation bias in depression, but the reading task is not sensitive enough to show this. However, we do get a different pattern of results as a function of cue and continuation, which suggests that the task is sensitive to cueing effects. Thirdly, interpretation biases in depression may only be found for a restricted class of stimuli, namely, self-referent negative information (Bradley & Mathews, 1983). Since the sentences presented were not self-referent, they may not have activated the relevant depressive schemas (Beck, 1967, 1976). Activation of depressed schemas may have only occurred if the sentences were similar to recent personal experiences e.g., loss

of a loved one, difficulties at work etc. Future studies need to use methodologies that include self-referent material to determine whether a negative interpretative bias occurs in depression. This could be attempted by presenting participants with ambiguous sentences and asking them to report whether they had personally experienced such scenarios (Lawson & MacLeod, 1999).

Furthermore, some of the sentences may not have been considered depressed-related and may not have activated the appropriate schemas (Beck, 1967, 1976). Although all sentences were piloted for suitability, it may have been preferable to have the sentences validated by professionals using anchored rating scales for depressed-theme content.

*Limitations*

There are several methodological issues that need to be considered when interpreting this study's findings. The study controlled for some key variables, such as age, number of years in education and gender ratio. However, future studies could also control for reading ability by using the Mill Hill Vocabulary Scale (MHV; Raven, Raven & Court, 1997). The MHV could be used to provide an index of intelligence to compare the two groups, since some individuals may not have understood the content of some sentences or been able to read individual words. This may have affected the findings.

In addition, although the study was strengthened by the use of a clinically depressed group as opposed to a mood-induced group or students with mild depression, future research may wish to use a larger sample since the study was relatively small in size. Furthermore, future studies could include a clinically anxious control group, since definite conclusions regarding the specificity of interpretative bias in anxiety versus depression would be inappropriate without such control.

Another methodological limitation involves the selection of the control group from friends and family. Some of the participants may not have felt able to report any past history of depression, thus introducing bias into the results. It would have been more appropriate to have selected participants unknown to the researcher.

A further limitation is that the reading task was lengthy and may have resulted in poor concentration especially for the depressed group. This may have resulted in the cue words and sentences not being read properly. However, it would be difficult to shorten the task since there are a number of different trials within the experiment. Psychomotor retardation as a symptom of depression may have also affected the results. In addition, the validity of the reading task is questionable e.g., whether the task really measures what it says it does. Furthermore, there may be difficulties with the ambiguous cue being a series of question marks and not a word since this is not matched like-for-like with the depressed and non-depressed cue words. It may have been preferable to include neutral words not linked to the ambiguous sentences as a control cue condition. Since these methodological limitations may have important implications, future research is required to specifically address such issues in the design of the task.

Finally, the effects of cognitive therapy were not considered in the analysis. Although the participants who were receiving cognitive therapy had only had a limited number of sessions, this may have resulted in schema change (Beck et al., 1979). Schema change may have affected interpretation, with depressed individuals less likely to have interpreted the ambiguous sentences negatively.

*Implications*

In terms of the cognitive models, it is still not clear which model best describes cognitive biases in emotional disorders. More experimental research is needed in the area

of interpretative bias and self-referent material in order to clarify which cognitive model best describes information processing biases in depression.

The present study has suggested that differences may exist between different emotions and different areas of information processing, since the RSVP paradigm resulted in threatening interpretation biases in high trait anxiety (MacLeod & Cohen, 1993) but not negative interpretations in clinical depression. However, there remains the need to understand and determine which mood state affects which information sub-process, to produce certain biases (Williams et al., 1997). Understanding these will help the clinical psychologist to link perception, attention, memory and interpretation with clinical phenomena.

In terms of clinical implications the results of the present study have shown that although depressed individuals show negative interpretative biases in some tasks, more sophisticated methodologies do not always reveal such biases. If future studies show no evidence for negative interpretative biases in depression, then cognitive behavioural strategies which aim to modify thoughts and beliefs (Beck et al., 1979) may need to be reconsidered. If future studies reveal evidence for elaborate processing in depression (i.e., negative memory biases) as suggested by Williams et al's. (1988, 1997) model, then clinical implications may need to focus on strategic aspects of negative memory rather than a general interpretative bias.

Whilst this study has shown mixed evidence for a negative interpretative bias in clinical depression, it is clear that more research is needed before firm conclusions can be made. In addition, it remains for future research to focus on specific individual differences that may mediate an interpretation bias effect.

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Table 1

*Characteristics (mean and SD) of each group including age, number of years in full-time education, Beck Depression Inventory (BDI) scores, Beck Anxiety Inventory (BAI) scores, homophone bias (percentage of negative interpretations) and recall bias (percentage of negative words recalled).*

| Variables | Group | | | | |
|---|---|---|---|---|---|
| | Depressed | | Control | | |
| | *M* | *SD* | *M* | *SD* | *p* |
| Age (years) | 45.33 | 7.16 | 41.96 | 9.25 | *ns* |
| No. years in education (years) | 13.46 | 3.30 | 14.50 | 2.27 | *ns* |
| BDI | 33.17 | 9.40 | 3.29 | 2.94 | <0.001 |
| BAI | 22.21 | 10.57 | 2.33 | 2.16 | <0.001 |
| Homophone bias (% negative interpretations) | 80.88 | 0.81 | 63.26 | 12.70 | <0.001 |
| Recall bias (% negative words recalled) | 68.16 | 26.95 | 38.70 | 19.93 | <0.001 |

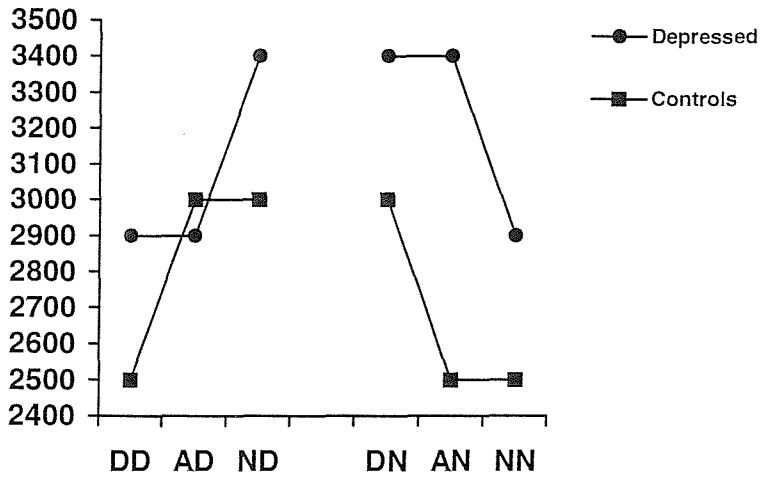
Table 2

*Mean number of positive and negative self-rated words, mean number of positive and negative words recalled and mean number of positive and negative intrusions for each group (and standard deviations).*

| | Group | | | |
|---|---|---|---|---|
| | Depressed | | Control | |
| | *M* | *SD* | *M* | *SD* |
| No. of words rated as self descriptive | | | | |
| Positive | 1.500 | 1.818 | 8.208 | 1.719 |
| Negative | 6.250 | 2.558 | 0.000 | 0.000 |
| No. of words recalled | | | | |
| Positive | 1.583 | 1.248 | 3.500 | 1.445 |
| Negative | 3.208 | 2.043 | 2.333 | 1.465 |
| No. of intrusions | | | | |
| Positive | 0.375 | 0.647 | 0.458 | 0.658 |
| Negative | 0.375 | 0.576 | 0.208 | 0.415 |

Figure 1

*Hypothesised reading patterns for the for the depressed and the control group*




Note: DD = depressed cue, depressed continuation

AD = ambiguous cue, depressed continuation

ND = non-depressed cue, depressed continuation

DN = depressed cue, non-depressed continuation

AN = ambiguous cue, non-depressed continuation

ND = non-depressed cue, non-depressed continuation

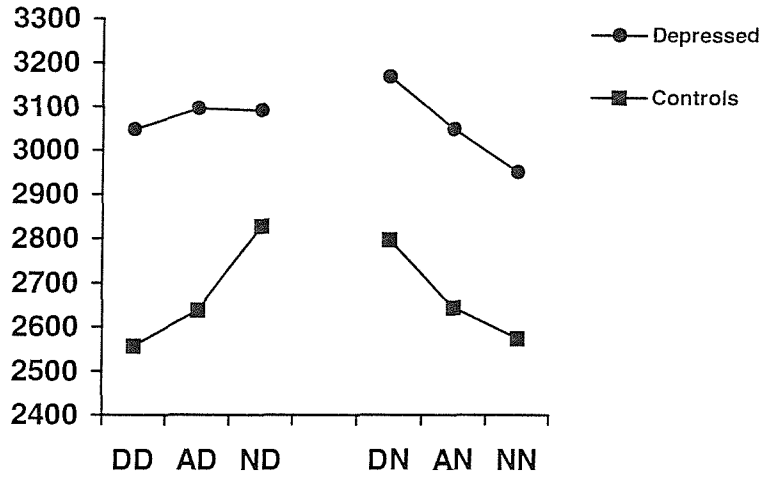
Table 3

*Mean Reading Times (in ms) for Each Group for the Six Different Trials*

| | Group | | | |
|---|---|---|---|---|
| | Depressed | | Control | |
| | *M* | *SD* | *M* | *SD* |
| DD | 3047.384 | 637.292 | 2556.635 | 644.815 |
| AD | 3095.203 | 779.985 | 2639.074 | 540.202 |
| ND | 3090.957 | 670.181 | 2827.606 | 752.612 |
| DN | 3168.007 | 680.400 | 2797.142 | 743.975 |
| AN | 3048.446 | 748.424 | 2644.092 | 627.635 |
| NN | 2951.643 | 769.005 | 2574.882 | 573.865 |

Figure 2

*Mean reading times (in ms) for the six trial types for the depressed and the control group.*




Note: DD = depressed cue, depressed continuation

AD = ambiguous cue, depressed continuation

ND = non-depressed cue, depressed continuation

DN = depressed cue, non-depressed continuation

AN = ambiguous cue, non-depressed continuation

ND = non-depressed cue, non-depressed continuation

## List of appendices

# Appendix 1

## Instructions to authors – Cognitive Therapy and Research

# Instructions to Contributors: Cognitive Therapy and Research

1. *Manuscripts, in quintuplicate and in English,* should be submitted to: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4. A title page is to be provided and should include the title of the article, author's name (no degrees), author's affiliation, and suggested running head. The affiliation should comprise the department, institution (usually university or company), city, and state (or nation) and should be typed as a footnote to the author's name. The suggested running head should be less than 80 characters (including spaces) and should comprise the article title or an abbreviated version thereof. For office purposes, the title page should include the complete mailing address, telephone number, and e-mail address (if applicable) of the one author designated to review proofs.

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6. A list of 4–5 key words is to be provided directly below the abstract. Key words should express the precise content of the manuscript as they are used for indexing purposes.

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8. Tables should be numbered (preferably with Roman numerals) and referred to by number in the text. Each table should be typed on a separate sheet of paper.

9. List references alphabetically at the end of the paper and refer to them in the text by name and year in parentheses.

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# Appendix 2

## Instructions to authors – Journal of Abnormal Psychology

Weisman, A., Lopez, S. R., Karno, M., & Jenkins, J. (1993). An attributional analysis of expressed emotion in Mexican American

Revision received September 29, 1998 ■
Accepted September 29, 1998 ■

## Instructions to Authors

### *Journal of Abnormal Psychology*

Most of the articles published in the *Journal of Abnormal Psychology* are reports of original research, but other types of articles are acceptable. Short Reports of replications or of failures to replicate previously reported results are given serious consideration. Comments on articles published in the journal are also considered. Case studies from either a clinical setting or a laboratory will be considered if they raise or illustrate important questions that go beyond the single case and have heuristic value. Manuscripts that present or discuss theoretical formulations of psychopathology, or that evaluate competing theoretical formulations on the basis of published data, may also be accepted. For further information on content, authors may refer to the editorial in the November 1995 issue of this journal (Vol. 104, No. 4, pp. 555–557).

Authors must prepare manuscripts according to the *Publication Manual of the American Psychological Association* (4th ed.). All manuscripts must include an abstract that contains a maximum of 960 characters and spaces (which is about 120 words) typed on a separate sheet of paper. All copy must be double-spaced, and further typing instructions, especially in regard to tables, figures, references, metrics, and abstracts, appear in the *Manual*. Also, all manuscripts are copyedited for bias-free language (see chap. 2 of the *Publication Manual*).

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Masked reviews are optional, and authors who wish masked reviews must specifically request them when they submit their manuscripts. For masked reviews, each copy of the manuscript must include a separate title page with the authors' names and affiliations, and these ought not to appear anywhere else in the manuscript. Footnotes that identify the authors must be typed on a separate page. Authors are to make every effort to see that the manuscript itself contains no clues to their identities.

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# Appendix 3

## Beck Depression Inventory II

# BDI®-II

Date:

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation: _____ Education: _____

**Instructions:** This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

### 1. Sadness

0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

### 2. Pessimism

0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

### 3. Past Failure

0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

### 4. Loss of Pleasure

0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

### 5. Guilty Feelings

0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

### 6. Punishment Feelings

0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

### 7. Self-Dislike

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

### 8. Self-Criticalness

0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

### 9. Suicidal Thoughts or Wishes

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

### 10. Crying

0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

_____ Subtotal Page 1

Continued on Back

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### 11. Agitation

0 I am no more restless or wound up than usual.

1 I feel more restless or wound up than usual.

2 I am so restless or agitated that it's hard to stay still.

3 I am so restless or agitated that I have to keep moving or doing something.

### 12. Loss of Interest

0 I have not lost interest in other people or activities.

1 I am less interested in other people or things than before.

2 I have lost most of my interest in other people or things.

3 It's hard to get interested in anything.

### 13. Indecisiveness

0 I make decisions about as well as ever.

1 I find it more difficult to make decisions than usual.

2 I have much greater difficulty in making decisions than I used to.

3 I have trouble making any decisions.

### 14. Worthlessness

0 I do not feel I am worthless.

1 I don't consider myself as worthwhile and useful as I used to.

2 I feel more worthless as compared to other people.

3 I feel utterly worthless.

### 15. Loss of Energy

0 I have as much energy as ever.

1 I have less energy than I used to have.

2 I don't have enough energy to do very much.

3 I don't have enough energy to do anything.

### 16. Changes in Sleeping Pattern

0 I have not experienced any change in my sleeping pattern.

1a I sleep somewhat more than usual.

1b I sleep somewhat less than usual.

2a I sleep a lot more than usual.

2b I sleep a lot less than usual.

3a I sleep most of the day.

3b I wake up 1–2 hours early and can't get back to sleep.

### 17. Irritability

0 I am no more irritable than usual.

1 I am more irritable than usual.

2 I am much more irritable than usual.

3 I am irritable all the time.

### 18. Changes in Appetite

0 I have not experienced any change in my appetite.

1a My appetite is somewhat less than usual.

1b My appetite is somewhat greater than usual.

2a My appetite is much less than before.

2b My appetite is much greater than usual.

3a I have no appetite at all.

3b I crave food all the time.

### 19. Concentration Difficulty

0 I can concentrate as well as ever.

1 I can't concentrate as well as usual.

2 It's hard to keep my mind on anything for very long.

3 I find I can't concentrate on anything.

### 20. Tiredness or Fatigue

0 I am no more tired or fatigued than usual.

1 I get more tired or fatigued more easily than usual.

2 I am too tired or fatigued to do a lot of the things I used to do.

3 I am too tired or fatigued to do most of the things I used to do.

### 21. Loss of Interest in Sex

0 I have not noticed any recent change in my interest in sex.

1 I am less interested in sex than I used to be.

2 I am much less interested in sex now.

3 I have lost interest in sex completely.



_____ Subtotal Page 2

_____ Subtotal Page 1

_____ Total Score

# Appendix 4

## DSM-IV diagnostic based questionnaire for mood disorders

NAME: NO:



**MAJOR DEPRESSION**

1a. Currently, have you been feeling depressed, sad, empty,
or have you lost interest or pleasure
in almost all of your usual activities ?

YES NO

1b. Currently, have other people commented to you that
you appear down or tearful or
that you seem less interested in your usual activities

YES NO

1c. Have you ever experienced a period of two weeks or more
when you felt depressed, sad, empty,
or lost interest or pleasure in your usual activities ?

YES NO

***If YES to either 1a, 1b or 1c or uncertain, continue enquiry.
If NO to all, skip to DYSTHYMIC DISORDER***

2. Now there's a list of questions about how you have felt nearly every day for the past two weeks. So for all of them it's: nearly every day in the past two weeks has/have:

| | | |
|---|---|---|
| your sleep been disturbed/changed | YES | NO |
| you been much more active or so slowed down you could hardly move | YES | NO |
| you felt tired/lacking in energy | YES | NO |
| you felt worthless or guilty (not just about being ill) | YES | NO |
| you had difficulty thinking, concentrating or making decisions | YES | NO |
| you had thoughts about death or hurting yourself | YES | NO |

your weight or appetite been different in the last two weeks from how it is normally

YES NO

## DYSTHYMIC DISORDER

1a. Over the past 2 years, have you frequently had days where you felt down, blue or depressed for most of the day ?
YES NO

1b. Over the past 2 years, have other people commented to you that you often appear down, blue or depressed
YES NO

If NO to 1a and 1b, go to 1c.

1c. Have you ever experienced a period when you felt down, blue or depressed more days than not for 2 years or more YES NO

If YES, When was the most recent time this occurred ?

***If YES to either 1a, 1b or 1c, continue with the enquiry
If not skip to MANIA***

CURRENT EPISODE

Now, I want to ask you a series of questions about this current period of time when you felt down or depressed.

1. What percentage of days over the past 2 years have you experienced a depressed mood for most of the day ? %

2. Over the past 2 years, have you had periods of 2 months or more when your mood was normal ? YES NO

5. Now there's a list of questions about your experiences during that time.
So for each one it's: during that time did you have/experience:

| | | |
|---|---|---|
| poor appetite or overeating | YES | NO |
| trouble sleeping, or sleeping too much | YES | NO |
| feeling tired all the time | YES | NO |
| being down on yourself, feeling like a failure | YES | NO |
| poor concentration or difficulty making decisions | YES | NO |
| feeling pessimistic about the future | YES | NO |

## MANIA

1a. Have you ever experienced a period of several days or more
when you felt unusually or excessively high or irritable ?
This is very different from being in a good mood or feeling the effects of
a substance. Yes / No

If Yes:

What I mean is a period where you felt persistently or abnormally high
or irritable, perhaps along with such things as a decreased need for sleep,
racing thoughts and distractibility,
and an unusual increase in the number of activities you got involved ?

YES NO

If YES, When was the most recent time this occurred ?

How long did this period last ?

# Appendix 5

## Beck Anxiety Inventory

BAI®

NAME _____ DATE _____

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by ymptom during the PAST WEEK, INCLUDING TODAY, by placing an X in the corresponding space in the column next to each symp

| | NOT AT ALL | MILDLY It did not bother me much. | MODERATELY It was very unpleasant, but I could stand it. | SEVERELY I could barely stand it. |
|---|---|---|---|---|
| 1. Numbness or tingling. | | | | |
| 2. Feeling hot. | | | | |
| 3. Wobbliness in legs. | | | | |
| 4. Unable to relax. | | | | |
| 5. Fear of the worst happening. | | | | |
| 6. Dizzy or lightheaded. | | | | |
| 7. Heart pounding or racing. | | | | |
| 8. Unsteady. | | | | |
| 9. Terrified. | | | | |
| 10. Nervous. | | | | |
| 11. Feelings of choking. | | | | |
| 12. Hands trembling. | | | | |
| 13. Shaky. | | | | |
| 14. Fear of losing control. | | | | |
| 15. Difficulty breathing. | | | | |
| 16. Fear of dying. | | | | |
| 17. Scared. | | | | |
| 18. Indigestion or discomfort in abdomen. | | | | |
| 19. Faint. | | | | |
| 20. Face flushed. | | | | |
| 21. Sweating (not due to heat). | | | | |

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# Appendix 6

## DSM-IV diagnostic based questionnaire for anxiety disorders

NAME:

## 1. PANIC DISORDER

Have you had times when you have felt a sudden intense anxiety, fear or discomfort?
YES / NO

-Do these feelings ever 'come out of the blue' for no apparent reason? YES / NO
-When in the situation does the anxiety come on immediately? YES / NO
-How long does it take for the anxiety to reach its peak level?.....
-How long does the fear usually last at this peak level?.....
-During the panic attack do you experience:

| | |
|---|---|
| Racing heart or palpitations | yes/no |
| Sweating | yes/no |
| Trembling or shaking | yes/no |
| Shortness of breath | yes/no |
| Feeling of choking | yes/no |
| Chest pain or discomfort | yes/no |
| Feeling hot or cold | yes/no |
| Dizziness | yes/no |
| Numbness or tingling sensations | yes/no |
| Fear of dying | yes/no |
| Feeling detached from yourself | yes/no |
| Fear of going crazy | yes/no |

## 2. AGORAPHOBIA

Do you feel panicky about being in places or situations, or avoid them? YES/NO

Have you ever felt panicky in any situations or avoided them because of panic?
YES/NO

Are you worried about entering situations in case you become dizzy, vomit etc?
YES/NO

## 3. PHOBIA

Do you have a marked or persistent excessive fear of a specific object/situation? YES/NO

-If yes, what.....
-Do you avoid being near the object/situation? YES/NO
-If exposed to the object/situation, would you experience anxiety? YES/NO
-Does the fear/avoidance interfere with your daily functioning? YES/NO

## 4. CLAUSTROPHOBIA

Are you afraid of small, enclosed spaces? YES/NO

Do you experience anxiety nearly every time you are in a small, enclosed space? YES/NO

## 5. SOCIAL PHOBIA

In social situations where you might be observed or evaluated by others, or when you are meeting new people, do you feel very fearful or anxious or nervous? YES/NO

-Are you currently overly concerned that you may do/say something that might embarrass or humiliate yourself in front of others? YES/NO

-Do you avoid social or performance situations, or endure with intense anxiety? YES/NO
-Does distress interfere with normal functioning? YES/NO

## 6. OCD

Are you bothered by thoughts, images or impulses that keep recurring to you that seem inappropriate or nonsensical, but you can't stop them coming into your mind? YES/NO

If yes, specify.....

-Do you feel driven to repeat some behaviour or to repeat something in your mind over and over again to try and feel less comfortable? YES/NO

-If yes, specify.....

## 7. PTSD

Have you ever personally experienced or witnessed a traumatic or life-threatening event? YES/NO

-Did you feel intensely helpless or horrified in that situation? YES/NO
-Do you have nightmares or flashbacks of that event? YES/NO
-Do you avoid situations that remind you of the event? YES/NO
-Do you have persistent symptoms of increased arousal? YES/NO

## 8. GAD

Over the last 6 months, have you been continually worried or anxious about a number of events or activities in your daily life? YES/NO

-Do you find it hard to control worry? YES/NO

-Do you have any of the following 6 symptoms which have been present more days than not in the past 6 months:
Restlessness/on edge
Easily fatigued
Irritability
Muscle tension
Sleep disturbance
Concentration problems

-Does your anxiety interfere with your daily functioning? YES/NO

## Appendix 7

## Information form (clinical group)

## Patient Information Form

### 1. Personal Details

Name ..... Number.....

Date .....

Age .....

Occupation.....

Number of years in full time education .....

Do you wear glasses? Yes/No Have you got them with you? Yes/No

Do you have any reading difficulties? Yes/No

### 2. Consent Form

### Experiments

3. Main Reading Task - cd sent, run boxsent, md mthday, copy *.dat mthday
   - **save:** copy *.dat a: (overwrite = yes)

4. Homophone Spelling Task

5. Self-Referent Memory Task

### Questionnaires

6. BDI

7. BAI

8. Diagnostic Assessment Interview

## 9. Details on Depression

1. How long have you currently been depressed for?

   .....

   .....

2. Have you had any other episodes of depression in the past? Yes/No

   If yes: How many?.....

   How long did they last?.....

3. Are you currently receiving treatment? Yes/No

   If yes: Are you receiving any of the following types of treatment and how long have you received this treatment for?

   a. Medication.....
   b. Cognitive therapy.....
   c. Other.....

   Who is treating you?.....

5. Have you had any treatment in the past? Yes/No

   If yes: What sort of treatment did you receive?

   a. Medication
   b. Cognitive therapy
   c. Other

   How long did you receive this treatment for?.....

6. Do you have any other psychological difficulties or diagnoses?.....

   .....

   .....

Fill out travel expenses form

# Appendix 8

## Information form (control group)

**Patient Information Form**
**(CONTROLS)**

## 1. Personal Details

Name ..... Number.....

Date .....

Age .....

Occupation.....

Number of years in full time education .....

Do you wear glasses? Yes/No Have you got them with you? Yes/No

Do you have any reading difficulties? Yes/No

## 2. Consent Form

### Experiments

3. Main Reading Task - cd sent, run boxsent, md mthday, copy *.dat mthday
   - **save:** copy *.dat a: (overwrite = yes)

4. Homophone Spelling Task

5. Self-Referent Memory Task

### Questionnaires

6. BDI

7. BAI

## 8. Past Information

All information obtained from this form will be treated with absolute confidentiality.

In the past when you have been emotionally upset, has it been so severe that you have:

a. Discussed it with a friend? yes/no

b. Visited your GP? yes/no

c. Received any treatment? yes/no

If yes, what type of treatment did you receive? Medication
Counselling
Cognitive therapy
Other

d. Attended a psychiatrist?

If you have ever received any treatment such as medication or professional counselling for an emotional problem, then:

a. was the problem predominantly feelings of tension and anxiety, or feelings of depression and hopelessness? anxiety/ depression

b. Is this still a current problem for you? yes/no

# Appendix 9

## Sentences used in the reading task

```
! main task - depression sentences + resp box
$ 1 Insert Form
"1\Lost\Draw\?????
\The artist could not trace the little child
\After several attempts the search had to be abandoned
\After several attempts the sketch had to be abandoned
\Did the artist abandon his attempt to trace the child?
\b\1\1"
"2\Cremate\Gift\?????
\Out of respect Mary kept the urn on the mantelpiece
\She would never have moved her father's ashes to another
room
\She would never have moved her father's present to another
room
\Did Mary resist moving her father's urn?
\b\1\2"
"3\Crash\Lost\?????
\The driver turned into the wrong lane
\The inevitable accident resulted in his absence at the
meeting
\The inevitable delay resulted in his absence at the meeting
\Did the driver make it to the meeting?
\m\1\3"
"4\Dead\Sleep\?????
\It was past 8.00 am and Mary could not wake her husband
\His death caused her extreme distress
\His laziness caused her extreme distress
\Was Mary upset about her husband's condition?
\b\1\4"
"5\Mistake\Lower\?????
\As the mountaineers returned from the top Alan let Phil
down
\He accidentally let the rope slide through his hands
\He carefully let the rope slide through his hands
\Was Phil being lowered by the rope?
\b\1\5"
"6\Fatal\Scuba\?????
\The diver sank to the bottom of the pool
\The injured diver remained under the water for several
minutes
\The scuba diver remained under the water for several
minutes
\Did the diver resurface immediately after touching the
bottom?
\m\1\6"
"7\Distress\Beckon\?????
\Kevin did not see his wife waving in the sea
\Otherwise he would have swum out to rescue her
\Otherwise he would have swum out to join her
```

\Did Kevin swim in the sea?
\m\1\7"
"8\Disaster\Theatre\?????
\The stage was set for the tragedy
\Over 200 people saw the accident
\Over 200 people saw the play
\Was the tragedy viewed by over 200 people?
\b\1\8"
"9\Burial\Renovate\?????
\They completed the service by filling the hole
\The funeral finished much sooner than everyone expected
\The repairs finished much sooner than everyone expected
\Did the service take more time than people thought?
\m\1\9"
"10\Disapproval\Invitation\?????
\The boy came home with a note for his parents
\He hung around dreading to see how they would react
\He hung around eager to see how they would react
\Did the boy wait for his parent's response to the letter?
\b\1\10"
"11\Flunked\Passed\?????
\Sean was shocked with his exam results
\With the amount of study he had done he had expected to fail maths
\With the amount of study he had done he had expected to pass maths
\Were Sean's exam results in Geography?
\m\1\11"
"12\Regret\Relief\?????
\As soon as Mark left, Mary noticed a change in her feelings
\She felt regretful that he had left her
\She felt relieved that he had left her
\Did Mary notice a change in her feelings when Mark left?
\b\1\12"
"13\Untalented\Admirable\?????
\The lead performer was commented on
\Most of the critics thought his acting had ruined the play
\Most of the critics thought his acting had saved the play
\Was the lead performer an actor?
\b\1\13"
"14\Fire\Bag\?????
\The farmer gave Dan the sack
\Following his advice, Dan began to look for more work
\Following his advice, Dan began to look for more potatoes
\Did the farmer give Dan some advice?
\b\1\14"
"15\Dismiss\Comment\?????
\The foreman was asked to report to the office
\The manager was waiting to discuss his future dismissal

\The manager was waiting to discuss his future promotion
\Was the manager waiting in the park?
\m\1\15"
"16\Failure\Success\?????
\Jill felt little emotion at her driving test results
\She had known that she would be unsuccessful
\She had known that she would be successful
\Had Jill anticipated the test results?
\b\1\16"
"17\Incompetent\Successful\?????
\Angela did not realise what her colleagues thought of her work
\Their criticisms were never made within her earshot
\Their praises were never made within her earshot
\Did Angela's friends often comment on her work in her presence?
\m\1\17"
"18\Sad\Glad\?????
\Peter was sure he had been wrongly placed in the second team
\He was disappointed about the selector's decision
\He was excited about the selector's decision
\Did the selector decide which team to put Peter in?
\b\1\18"
"19\Upset\Happy\?????
\Seeing Emma with Tom filled her father with emotion
\It made him upset to see them both together
\It made him happy to see them both together
\Did Emma's father show any emotion when he saw them together?
\b\1\19"
"20\Funeral\Festival\?????
\The child and her sister followed the procession
\The depressing atmosphere affected everyone's mood
\The festive atmosphere affected everyone's mood
\Were people emotionally influenced by the procession?
\b\1\20"
"21\Depressed\Pleasure\?????
\The music stirred feelings long buried in Alex
\This sad mood was caused by some of the memories it evoked
\This happy mood was caused by some of the memories it evoked
\Did the music bring back the past for Alex?
\b\2\1"
"22\Desertion\Forgetful\?????
\Mrs Evans didn't bother to leave her husband a note when she left
\It was late in the afternoon when she decided to move out
\It was late in the afternoon when she decided to go out

\Did Mrs Evans leave her husband a note before she left?
\m\2\2"
"23\Mourning\Christmas\?????
\It was snowing heavily when the wreath arrived
\The family watched as it was put on the coffin
\The family watched as it was put on the door
\Was it raining when the wreath arrived?
\m\2\3"
"24\Stupid\Witty\?????
\Stephen's speech made everyone giggle
\His choice of words reflected his stupidity
\His choice of words reflected his wit
\Was Stephen doing a cooking demonstration?
\m\2\4"
"25\Guilty\Trusted\?????
\At the hearing the solicitor proved Mark was responsible
\Everyone in the court agreed he was guilty
\Everyone in the court agreed he was trustworthy
\Did everyone agree that Mark was judged correctly?
\b\2\5"
"26\Unwelcome\Welcoming\?????
\Tom's arrival at the party was unexpected
\Nobody at the party was pleased to see him
\Everybody at the party was pleased to see him
\Did the people expect to see Tom?
\m\2\6"
"27\Dull\Fun\?????
\Lindsay's expectations of the party were correct
\She had only decided to go at the last minute and it was boring
\She had only decided to go at the last minute and it was excellent
\Had Lindsay been planning to go to the party for weeks?
\m\2\7"
"28\Complaining\Compliment\?????
\The couple called the chef to the table
\They wanted to tell him how disappointed they were with the meal
\They wanted to tell him how pleased they were with the meal
\Did the couple call the chef to discuss the weather?
\m\2\8"
"29\Malpractice\Seminar\?????
\The surgeon's work had been closely observed
\The hospital staff recognised how incompetent he was
\The hospital staff recognised how skilful he was
\Was the surgeon's work ignored by the hospital staff?
\m\2\9"
"30\Ridicule\Entertain\?????
\The man's presentation made the class laugh

\He made lots of silly mistakes in his presentation
\He made lots of silly jokes in his presentation
\Was the man giving a presentation?
\b\2\10"
"31\Boyfriends\Fruit\?????
\After lunch the girl's mother commented that she had not had many dates
\The girl put it down to her lack of personality
\The girl put it down to her lack of appetite
\Did the girl's mother comment on her having few dates?
\b\2\11"
"32\Rejecting\Day-dreaming\?????
\Sheila's friends commented that her boyfriend seemed inattentive
\His unfriendliness was the topic of much discussion
\His absent-mindedness was the topic of much discussion
\Was Sheila's boyfriend discussed by her friends?
\b\2\12"
"33\Criticism\Praise\?????
\Brad's assignment was returned covered in comments
\His lecturer was not impressed with his work
\His lecturer was very impressed with his work
\Did Brad's lecturer make many comments on the assignment?
\b\2\13"
"34\Error\Petticoat\?????
\The young seamstress had made many slips
\Her incompetence was noted by her supervisor
\Her efficiency was noted by her supervisor
\Did the seamstress's performance go unnoticed?
\m\2\14"
"35\Unemployed\Timber\?????
\The young handyman was given the axe
\His boss told him to go and look for more work
\His boss told him to go and look for more wood
\Did the boss tell the young handyman to stay?
\m\2\15"
"36\Naughty\Polite\?????
\People often commented to the couple about their son's behaviour
\He was a very bad mannered child
\He was a very well mannered child
\Did the couple ever receive comments regarding their son's behaviour?
\b\2\16"
"37\Deceased\Baptism\?????
\Many people had tears in their eyes during the afternoon service
\The funeral was very moving
\The christening was very moving

\Did people find the service moving?
\b\2\17"
"38\Unsuccessful\Employed\?????
\Following his job interview Paul was surprised by the panel's decision
\He had thought they were unwilling to give him the job
\He had thought they were keen to give him the job
\Had Paul correctly guessed his chances of getting the job?
\m\2\18"
"39\Loss\Profit\?????
\The shopkeeper was shocked when he counted the day's takings
\He had made much less than usual
\He had made much more than usual
\Had the shopkeeper made the same amount of money as usual?
\m\2\19"
"40\Punishment\Training\?????
\Felix often had to stay behind after school
\He had detention several days a week
\He had commitments several days a week
\Did Felix go straight home after school?
\m\2\20"
"41\Poor\Wealthy\?????
\Joe felt faint when the roulette wheel finally stopped spinning
\He had just lost a large amount of money
\He had just won a large amount of money
\Had Joe placed a bet on the roulette wheel?
\b\3\1"
"42\Worried\Delighted\?????
\Tony's report left his parents speechless
\His grades had slipped a great deal
\His grades had improved a great deal
\Were Tony's parents surprised by the change in his grades?
\b\3\2"
"43\Fat\Sculpture\?????
\The art student's large figure had drawn a lot of attention
\Many people had noticed her increasing weight
\Many people had noticed her increasing talent
\Did the art student's figure go unnoticed?
\m\3\3"
"44\Disappointment\Improvement\?????
\Everyone was surprised by Mark's 4th place in the finals
\Before the competition he was ranked higher
\Before the competition he was ranked lower
\Was Mark's performance in the finals expected?
\m\3\4"
"45\Overdrawn\Rich\?????
\Robert was astonished by his bank statement

\He decided his wife must have withdrawn some money
\He decided his wife must have deposited some money
\Had Robert previously known about his wife's transaction?
\m\3\5"
"46\Rejected\Late\?????
\When John walked in the pub, his friend had not arrived
\John realised his friend did not want to see him
\John realised his friend was delayed in traffic
\Did John go to the pub?
\b\3\6"
"47\Worst\Best\?????
\The report on Sally's department drew a lot of attention
\Sally's department had received the poorest rating in the company
\Sally's department had received the highest rating in the company
\Was Sally's department the focus of much attention?
\b\3\7"
"48\Divorce\Arithmetic\?????
\The division had been a long process for Bobby
\He had tried hard to work at his relationship problems
\He had tried hard to work at his maths problems
\Had Bobby attempted to work at his problems?
\b\3\8"
"49\Belittle\Piggyback\?????
\Lisa asked her father not to put her down
\She preferred it when he praised her
\She preferred it when he carried her
\Did Lisa prefer it when her father did not put her down?
\b\3\9"
"50\Poverty\Hole\?????
\People tried to identify the cause of the depression in the land
\Many were puzzled by the great recession
\Many were puzzled by the great crater
\Did the people know the cause of the depression?
\m\3\10"
"51\Friendless\Delay\?????
\Peter is leaving for work on his birthday, but no cards have arrived
\He realises that no-one has sent him any cards
\He realises that the postman is running late
\Was it Peter's birthday?
\b\3\11"
"52\Sorrow\Joy\?????
\The man wept after hearing the jury's verdict
\Their decision filled him with despair
\Their decision filled him with relief
\Was the man emotionless after hearing the verdict?

\m\3\12"
"53\Struggling\Prosperous\?????
\Since shifting jobs Karen had felt a change in her finances
\She was not able to afford many luxuries
\She was now able to afford many luxuries
\Had Karen's finances stayed the same?
\m\3\13"
"54\Wedding\Dinner\?????
\Margaret had decided to break her engagement
\The marriage no longer fitted in with her plans
\The appointment no longer fitted in with her plans
\Did Margaret's engagement still fit in with her plans?
\m\3\14"
"55\Delayed\Prompt\?????
\It was half past the hour when Sue arrived for her 12.00 appointment
\She had not anticipated arriving so late
\She had not anticipated arriving so early
\Had Sue misjudged her arrival for the interview?
\b\3\15"
"56\Withdrawn\Romantic\?????
\Mandy thought Steve's attitude towards their relationship had changed
\He seemed less enthusiastic about their future together
\He seemed more enthusiastic about their future together
\Had Steve's enthusiasm toward his relationship with Mandy stayed the same?
\m\3\16"
"57\Underpaid\Overpaid\?????
\Michelle was surprised by the amount in her pay packet
\It was far less than she usually received
\It was far more than she usually received
\Had Michelle received the usual amount in her pay packet?
\m\3\17"
"58\Jail\Pub\?????
\Working behind bars had given Sam a different view on life
\The prisoners' problems greatly affected his attitude
\The customers' problems greatly affected his attitude
\Had Sam's attitude stayed the same since working behind bars?
\m\3\18"
"59\Last\Win\?????
\Justin was a long way from the other runners as he finished the race
\He was behind the others by a considerable distance
\He was ahead of the others by a considerable distance
\Was Justin close to the other runners as he finished the race?
\m\3\19"

"60\Fail\Intelligent\?????
\Craig left the examination an hour early
\He had been unable to answer all of the questions
\He had been able to answer all of the questions
\Did Craig leave the examination early?
\b\3\20"
"61\Worse\Better\?????
\The man commented on Jane's recent change in appearance
\She looked fatter than usual
\She looked slimmer than usual
\Had the man commented on Jane's sense of humour?
\m\4\1"
"62\Disike\Like\?????
\Tom told Susie that he had strong feelings about her
\He hated the way she treated him
\He loved the way she treated him
\Did Tom have strong feelings towards Susie?
\b\4\2"
"63\Unfriendly\Friendly\?????
\The man shouted to Mary from the other side of the street
\He tried to put her down
\He tried to get her attention
\Was the man on the same side of the street to Mary?
\m\4\3"
"64\Incompatible\Compatible\?????
\Charlie knew he was responsible for introducing Ann to Tom
\He felt bad about introducing them
\He felt glad about introducing them
\Did Charlie organise their meeting?
\b\4\4"
"65\Embarrassment\Pride\?????
\Phil was very aware of the appearance of his girlfriend
\He was embarrassed by her looks
\He was proud of her looks
\Did Phil have a girlfriend?
\b\4\5"
"66\Rejection\Absailing\?????
\The girl let John down gently
\He felt upset by her actions
\He felt relieved by her actions
\Was John let down by a boy?
\m\4\6"
"67\Ridicule\Admire\?????
\Jim didn't expect to be talked about in public
\His failure was the talk of the town
\His success was the talk of the town
\Did people talk about Jim?
\b\4\7"
"68\Bad\Good\?????

\Kate's last decision had affected her career path
\Her decision had resulted in her sacking
\Her decision had resulted in her promotion
\Did Kate's decision affect her career path?
\b\4\8"
"69\Miserable\Winter\?????
\The next few months were expected to be rather dull
\Joe always anticipated his depression at this time of year
\Joe always anticipated bad weather at this time of year
\Did the next few months look good?
\m\4\9"
"70\Cruel\Engagement\?????
\Rumours were flying about Andy's relationship with his girlfriend
\He had always been horrible to her
\He had always been devoted to her
\Did Andy have a girlfriend?
\b\4\10"
"71\Humiliated\Pleased\?????
\Sharon became red in the face when she told them what happened
\Sharon felt embarrassed by the actions she had taken
\Sharon felt delighted by the actions she had taken
\Did Sharon's face turn white?
\m\4\11"
"72\Spiteful\Clown\?????
\The girls laughed at Bob's new outfit at the party
\He didn't realise he would be so ridiculed
\He didn't realise he would be so appreciated
\Did the girls laugh at Bob?
\b\4\12"
"73\Competition\Reference\?????
\Rachel knew it was down to her that John got the job
\She felt upset by the outcome
\She felt pleased by the outcome
\Did Rachel get the job?
\m\4\13"
"74\Differing\Nod\?????
\Ann noticed that Tim moved his head when she spoke in the meeting
\He always disagreed with her ideas
\He always agreed with her ideas
\Was Tim absent at the meeting?
\m\4\14"
"75\Negative\Positive\?????
\David was surprised by Susan's reaction to his letter
\He had not expected the letter to cause so much upset
\He had not expected the letter to cause so much joy
\Was David surprised by Susan's reactions?

\b\4\15"
"76\Shame\Pride\?????
\The girl blushed at the others' comments about her work
\She was ashamed of what she had done
\She was proud of what she had done
\Did the other people comment on the girl's work?
\b\4\16"
"77\Death\Marriage\?????
\Carol felt emotional throughout the service
\Funerals always made her cry
\Weddings always made her cry
\Did Carol feel emotional?
\b\4\17"
"78\Withdrawn\Dedicated\????
\Clare was quiet while she worked in the office
\Her depression prevented her from chatting to her colleagues
\Her concentration prevented her from chatting to her colleagues
\Was Clare in the park?
\m\4\18"
"79\Disagreement\Exercise\?????
\Peter was exhausted at the end of the long day
\The argument had worn him out
\The marathon had worn him out
\Was Peter full of energy?
\m\4\19"
"80\Comments\Rugby\?????
\Dave felt extreme pressure from the rest of the team
\Their heavy criticisms affected him
\Their heavy weight affected him
\Was Dave feeling relaxed?
\m\4\20"
! practice -dep + resp box
$ 9 Insert Form
"1\Victory\\
\Jill was not surprised to see that Mark had won the race
\She was always very confident in his driving skills
\\Did Jill believe that Mark was a competent driver?
\b\9\1"
"2\Celebration\\
\Jenny couldn't wait to get to work on her birthday
\Wendy had told her that everyone had arranged a surprise party for her
\\Had Wendy told Jenny a secret?
\b\9\2"
"3\Rejoice\\
\Henry was filled with joy and elation as he sang the carols
\Christmas was his very favourite time of year

\\Did Henry dislike singing carols?
\m\9\3"
"4\Noise\\
\The workman's banging was disturbing Michael's concentration
\He finally decided to take his reading to the library
\\Did Michael immediately leave for the library?
\m\9\4"
"5\Conflict\\
\The crowd watched in horror as the two men fought
\They couldn't believe that the argument had ended in such tragedy
\\Did more than one person watch the fight?
\b\9\5"
"6\Tease\\
\Everyone loved to make fun of Janet
\Her eccentricity made her an easy target
\\Was Janet seen as being different to most people?
\b\9\6"
"7\?????\\
\Jane was sad when Alex boarded the plane
\She knew it would be years before she would see him again
\\Would Alex return within the next few months?
\m\9\7"
"8\?????\\
\Maggie was tired of hearing her colleague's criticisms
\She was sure that he was trying his best to upset her
\\In Maggie's view were her colleague's criticisms intentional?
\b\9\8"
"9\?????\\
\The jury's decision to convict John was unanimous
\There was overwhelming evidence that he was guilty of a malicious crime
\\Did anyone in the jury disagree with the final verdict?
\m\9\9"
"10\?????\\
\Peter was sure that he would do exceptionally well in his final exams
\He had been preparing for them for over six months
\\Did Peter believe that he might not attain good academic achievements?
\m\9\10"
"11\?????\\
\Margaret and Stephanie were so happy to finally see one another
\The two sisters sat up all night talking and drinking champagne
\\Were Margaret and Stephanie related?

```
\b\9\11"
"12\?????\\
\It was the first time that Jean had cooked Chinese food
\She was very pleased that everyone enjoyed the meal
\\Had Jean cooked Won Ton soup before?
\m\9\12"
! block insert - practice
$ 10 Insert Form
#10 1
#10 2
#10 3
#10 4
#20 5
#20 6
! block insert - main task
$ 11 Insert Form
#10 1
#10 2
#10 3
#10 4
#20 5
#20 6
```

# Appendix 10

## Words used in the homophone task

**Words for the Homophone Spelling Task**

**(neutral and homophone words)**

1. Mint
2. Petal
3. Die/dye
4. Rabbit
5. Slay/sleigh
6. Foul/fowl
7. Melon
8. Rake
9. Moan/mown
10. Groan/grown
11. Stag
12. Spade
13. Liar/lyre
14. Play
15. Bore/boar
16. Pain/pane
17. Weak/week
18. Trade
19. Mobile
20. Willow
21. Skull/scull
22. Tease/teas
23. Poodle
24. Bury/berry
25. Month
26. Deed
27. Guilt/gilt
28. Flu/flew

## Appendix 11

### Response sheet for the homophone task

## Response Sheet

**Name:**

Please listen to the following words and write them down in the space below:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

21.

22.

23.

24.

25.

26.

27.

28.

## Appendix 12

## Response sheet for the memory task

## Response Sheet

Please listen to the following words. For each word, please note below whether it currently describes you.

1. yes no
2. yes no
3. yes no
4. yes no
5. yes no
6. yes no
7. yes no
8. yes no
9. yes no
10. yes no
11. yes no
12. yes no
13. yes no
14. yes no
15. yes no
16. yes no
17. yes no
18. yes no
19. yes no
20. yes no
21. yes no
22. yes no
23. yes no
24. yes no
25. yes no
26. yes no

## Appendix 13

## Words used in the memory task

## Randomised Order of Presentation

1. **Tidy**
2. **Small** — **neutral words to account**
3. **Tired** — **for the primacy effect**
4. Inspired
5. Hopeless
6. Cheerful
7. Awful
8. Secure
9. Merry
10. Upset
11. Depressed
12. Isolated
13. Energetic
14. Gloomy
15. Dreadful
16. Terrible
17. Peaceful
18. Lonely
19. Joyful
20. Active
21. Jolly
22. Guilty
23. Pleasant
24. **Tall**
25. **Blond** — **neutral words to account**
26. **Polite** — **for the recency effect**

# Appendix 14

## University ethical approval form

University of Southampton | Finance Department

# Memorandum

| | | | |
|---|---|---|---|
| **From:** | Ruth McFadyen | **To:** | Mrs K Bradbury |
| **Ext:** | 22417 | **Dept:** | Clinical Psychology |
| **E-mail:** | hrm@soton.ac.uk | **Date:** | 14 December 2000 |

---

**Reference:** CLNTRL/HRM/GFT

**Professional Indemnity Insurance**

**Project No: 225/00**

**Does a Negative Interpretation Bias Exist in Patients with Clinical Depression?**

Thank you for forwarding the completed questionnaire and attached papers.

Having taken note of the information provided, I can confirm that this project will be covered under the terms and conditions of the above policy, subject to written consent being obtained from the participating volunteers and approval from the appropriate local Ethics Committee.

Ruth McFadyen
**Insurance Administrator**

# Appendix 15

## Local research ethical approval form

**SOUTHAMPTON & SOUTH WEST HANTS**
**JOINT LOCAL RESEARCH ETHICS COMMITTEE**

**Chairman: Dr Audrey Kermode**

**Administrator: Mrs Clair Wright**
Trust Management Offices
Mailpoint 18
Southampton General Hospital
Tremona Road
Southampton
SO16 6YD

**Tel: (023) 8079 4912**
**Fax: (023) 8079 8678**

Ref: CPW/DBL

9th October 2000

Mrs K Bradbury
63 Winchester Road
Romsey
Hants SO51 8JB

Dear Mrs Bradbury

**Submission No:225/00 - Does a negative interpretation bias exist in patients with clinical depression?**

Following the conditional approval and in response to your letter dated 8th September 2000, I am pleased to confirm **full approval** having satisfied the Committees concerns, receiving the Head of Department signature and that the data protection officer has now been informed as requested.

This approval was granted by the Committee at their meeting on 25th October 2000.

This committee is fully compliant with the International Committee on Harmonisation/Good Clinical Practice (ICH) Guidelines for the Conduct of Trials involving the participation of human subjects as they relate to the responsibilities, composition, function, operations and records of an independent Ethics Committee/Independent Review Board. To this end it undertakes to adhere as far as is consistent with its Constitution, to the relevant clauses of the ICH Harmonised Tripartite Guideline for Good Clinical Practice, adopted by the Commission of the European Union on 17 January 1997.

Yours sincerely,

pp Mary Connelly

**Clair Wright (Mrs)**
Research Ethics Administrator

# Appendix 16

## Letter to consultants

SOUTHAMPTON HEALTH COMMUNITY SERVICES NHS TRUST

**Department of Psychiatry**
Royal South Hants Hospital,
Brintons Terrace,
off St. Mary's Road,
Southampton, SO14 0YG

Telephone: 01703 634288
Fax: 01703 825672/233189

Date

Dear Dr.

I am a second year Trainee Clinical Psychologist on placement with Su Ross, Clinical Psychologist at the Department of Psychiatry, Royal South Hants Hospital. I am interested in the area of clinical depression and as part of my doctoral studies I am proposing to carry out a study looking at cognitive biases in clinical depression.

My aim is to establish whether clinically depressed people are more likely to interpret ambiguous sentences negatively when compared to non-clinical controls, and if so, whether this occurs for all information or self-referent information only. An understanding of this will allow the development of appropriate psychological treatment strategies. I will also be looking at interpretation of words through a spelling task using homophones e.g., die/dye, mown/moan. Negative interpretation of homophones in clinically depressed people has already been established and will allow a comparison with the present study. A short memory task will also be used to determine whether negative words are more likely to be recalled than other words.

Would it be possible to involve you and your patients in this research study? The research is being carried out under supervision of both Su Ross and Professor Brendan Bradley at the Southampton University Training Course. Ethical permission is currently being sought from the University of Southampton and the Southampton and Winchester Ethics committees. No research will go ahead without the consent of all these committees.

Your involvement would entail providing me with the names of patients who have a primary diagnosis of unipolar depression. The actual study will involve patients attending an interview to complete some questionnaires and to carry out the reading task via a computer and a further spelling and memory task. The participants will be blind to the aim of the study. They will be informed that the study is interested in reading speed rather than interpretation bias. This will help to reduce bias in the results. The tasks will take approximately one hour and would cause no distress to the individual, who would be assured that they could withdraw at any time. The participants would not be involved in any other study.

If you feel you are able to be involved, please contact me at the above address (via Su Ross) and I will be pleased to give you further information that you require. I would be happy to present the results on completion of the study.

Thanking you in anticipation.

Yours sincerely,

Katherine Bradbury
(Trainee Clinical Psychologist)



**Mental Health and Learning Disabilities Service**

## Appendix 17

## Information sheet

SOUTHAMPTON HEALTH NHS COMMUNITY SERVICES TRUST

**Psychological Therapies Service**
**Department of Psychiatry**
Royal South Hants Hospital,
Brintons Terrace,
off St. Mary's Road,
Southampton, SO14 0YG

Telephone: 023 80 634288
Fax: 023 80 825693
Website: www.schs.org.uk

September 2000, Version 1a

# Information Sheet

## Cognitive Processes in Depression

You have been invited to take part in a research study. Before you decide whether you want to take part in the study, this sheet provides information about why the study is being done and what it will involve. You may wish to discuss it with your clinician who you have had your appointment with or the researcher involved, or anyone else. Please ask if there is anything that is not clear or if you would like more information. You may take time to decide whether or not you wish to take part.

The study aims to develop an understanding of cognitive processes in depression e.g., reading speed and memory.

The study will involve meeting with me for about an hour to complete some questionnaires and talk about your current situation. At that point you will be asked if you are willing to carry out a short reading, spelling and memory task. You will be under no obligation to do so and can withdraw from the study at any time without this having any effect on your current treatment.

All information collected during the course of the study will be kept strictly confidential and will be used only for this study. Identifying information e.g., names etc, will be deleted to ensure anonymity and identity numbers used instead so that you would not be recognised by the answers you give. Your family GP would be notified that you have agreed to take part in the research.

The results of the study will be written up by the researcher as part of a training course in clinical psychology. If you would like a summary of the results, then please indicate this on the final sheet you are given with the address to which they are to be sent. I will be happy to forward these. The study has been reviewed by the Southampton Ethics Committee.

If you do decide to take part you will be given this information sheet to keep and would be asked to sign a consent form. A meeting will be arranged when I have received this. If in the meantime you have any questions about the study then please contact myself: Katherine Bradbury, Trainee Clinical Psychologist, on the above address.

Many thanks for taking part in this study.

Centre Number:
Study Number:
Patient Identification Number:



**Mental Health & Learning Disabilities Service**

## Appendix 18

## Consent form

SOUTHAMPTON HEALTH NHS COMMUNITY SERVICES TRUST

**Psychological Therapies Service**
**Department of Psychiatry**
Royal South Hants Hospital,
Brintons Terrace,
off St. Mary's Road,
Southampton, SO14 0YG

Telephone: 023 80 634288
Fax: 023 80 825693
Website: www.schs.org.uk

# Consent Form

**Title of Project:** Cognitive Processes in Depression

**Name of Researcher**: Katherine Bradbury

**Please Initial Box**

1. I confirm that I have read and understood the Information Sheet dated..... (version.....) for the above study and have the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason and without affecting my medical care. ☐

3. I agree to take part in the above study ☐

| ..... | ..... | ..... |
|---|---|---|
| Name of Participant Taking Consent | Date | Signature |

| ..... | ..... | ..... |
|---|---|---|
| Researcher | Date | Signature |

INVESTOR IN PEOPLE

POSITIVE ABOUT DISABLED PEOPLE

**Mental Health & Learning Disabilities Service**