

An examination of the relationship between depression, autobiographical memory specificity and executive function

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A good writer possesses not only his own spirit but

also the spirit of his friends - Friedrich Nietzsche

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Abstract

This thesis is submitted in partial fulfilment of a Doctorate in Clinical Psychology at the University of Liverpool. It focuses on the frequently reported finding of reduced specificity of autobiographical memory in participants diagnosed with depression (Williams & Broadbent; 1986, van Vreeswijk & de Wilde; 2004). That is, difficulty recalling the *who*, *what*, *where* and *when*, of a remembered event. The focus of investigation particularly within the thesis is that of executive functioning; a term describing a range of higher order cognitive functions that control and integrate other activities such as planning, sequencing, initiation. It is examined in relation to depression. The thesis is presented in paper form; Chapter 1 contains a systematic review of 9 research studies related to executive function in the memory specificity of participants with a diagnosis of depression. While executive functioning does appear to be related to reduced specificity the findings in the literature are not consistent highlighting the need for further research. The original empirical paper presented in Chapter 2 tests out hypotheses related to the claims of reduced specificity and executive functioning in participants with a diagnosis of depression (Burt, Zembor, & Niederehe, 1995). These hypotheses are based on the conclusions drawn from the review paper in Chapter 1. It concludes that while overall participants with a diagnosis of depression produce fewer memories overall, and particularly fewer specific memories, this difference can be reduced with modified materials which are more concrete and imaginable. These modified materials can also produce more specific memories overall. In addition, regardless of depression status, executive functioning has a significant impact on autobiographical memory specificity. These key findings are developed in an extended discussion in Chapter 3 and discussed in terms of their value and application to practices in clinical psychology. Chapter 3 also contains research dissemination for participants and a future research proposal expanding the scope of investigation from depression to trauma.

Overall introduction

The thesis consists of three chapters. Chapter 1 contains a systematic review investigating the role of depression and executive functioning in studies researching autobiographical memory. Chapter 2 introduces a research study which explores the relationship empirically with a modified test of autobiographical memory, designed to elicit greater specificity in participants. Chapter 3 contains an extended discussion of the empirical study exploring the findings in the therapeutic context and in terms relation to models of memory. Dissemination produced for participants of the experiment is presented in addition to a proposal for future research developed from the study from Chapter 2.

All sections of the thesis explore the theme of autobiographical memory in participants with a diagnosis of depression. Autobiographical memory describes the recall of past events of a person's life that contribute to their sense of self (Conway, 2005). A widespread research finding in participants with a diagnosis of depression is a reduction in producing rich information about the *who, what, where* and *when* of a remembered event known as reduced specificity of autobiographical memory in depression (Williams & Broadbent, 1986; van Vreeswijk & de Wilde, 2004). One cognitive process that has been implicated in this reduction is executive functioning. This term describes higher order cognitive structures and processes responsible for integrating and controlling other cognitive activities such as sequencing, planning and initiation.

Depression is a pervasive and potentially severe mental health difficulty which can have very detrimental effects on a person's life, the family and friends around them and on the wider system in terms of the economic cost of depression. For example, McCrone et al. (2008) predict that in the UK in 2026, £12.2 billion will be lost due to people unable to work due to depression and that the cost for services will be £3 billion. With personal and societal costs such as this it is imperative that continued research is conducted to investigate the structure, mechanisms and maintaining factors involved in depressive disorders. In this way we can improve psychological services to assess formulate and treat depression and to reduce peoples vulnerability for future episodes.

The systematic review in Chapter 1 focuses on the role of executive functioning in studies which investigate reduced specificity of autobiographical memory in depression. The over-arching aim of the review was to explore whether executive functioning was implicated in the literature relating to reduced specificity of autobiographical memory and depression, and if this was the case to explore the explanations given for this relationship. In addition, the review examines the implications for psychological assessment, formulation, intervention and future research. The review used three electronic data bases (PsychINFO, Scopus and Web of Knowledge) to identify 191 articles. Of this initial figure, 9 studies met the inclusion criteria and were included in the systematic review. The findings demonstrated three important points: 1) the importance of executive functioning in the depression/reduced specificity relationship, 2) executive functioning appears to be important in the maintenance and course of depression, and 3) executive functioning has implications for vulnerability to future episodes of depression. The review explored these relationships and discusses them in terms of a) the importance for future research b) psychological assessment, formulation and intervention and c) theory/models of memory. The systematic review concludes therefore that that executive functioning plays an important role in the oft reported finding of reduced specificity of autobiographical memory in depression. However it is still not clear how executive functioning interacts with other factors to create reduced specificity and the mechanisms by which it leads to reduced specificity. Continued research is called for based on the findings which expands the range of executive functioning tests used, utilising participants with a current diagnosis of depression in order to further investigate specificity, mood and executive functioning. These recommendations were implemented in the empirical paper in Chapter 2.

The study presented in Chapter 2 therefore investigated the role of executive functioning on autobiographical memory specificity in participants diagnosed with depression. This paper was prepared for submission to the Wiley journal Depression and Anxiety. A modified version of the autobiographical memory test (AMT) was constructed which consisted of words rated more highly for concreteness, imaginability and specificity. In addition the traditional AMT used by Williams and

Broadbent (1986) was given to participants in order that it could be compared with the modified test. The study thus aimed to elicit more specificity with the modified AMT in participants and explore the relationship between specificity and executive functioning. The results using the modified AMT demonstrated that participants with a diagnosis of depression recalled significantly fewer specific autobiographical memories than matched controls, a replication of previous literature. When executive functioning was run as a covariate this effect was still present on the traditional AMT but disappeared with the modified test demonstrating the importance of executive functioning and that greater specificity can be elicited. Participants with a diagnosis of depression also recalled more over-general memories than matched controls on the traditional AMT however there was no difference in number of general memories recalled on the new modified AMT. For both the traditional and modified AMT there was a mood congruence effect. Participants with current low mood recalled fewer positive specific autobiographical memories. Correlations between various measures taken and executive functioning were also explored and discussed. The findings are discussed in terms of theoretical implications and the clinical issues in terms of assessment, formulation, relationships with other processes. Clinical psychologists may integrate these findings into their practice for example methods of enhancing executive functioning in order to encourage recovery from depression and also to reduce future vulnerability.

The discussion from the empirical paper in Chapter 2 is extended in Chapter 3. In addition Chapter 3 contains the dissemination information provided to research participants and a future study based on the findings of the study. The proposed research extends the empirical study from Chapter 2 to the field of trauma. The study in Chapter 2 demonstrates that that using a modified version of the autobiographical memory test could elicit greater specificity in participants with a diagnosis of depression and this has also been found to be the case for individuals who have been exposed to trauma (Hauer, Wessel, Geraerts & Dalgleish, 2008). There have been no empirical studies to date investigating the role of executive functioning and specificity of autobiographical memory in individuals with a history of trauma however. Therefore the research aims to study this

relationship using the traditional autobiographical memory test, the modified test used in Chapter 2 designed to elicit greater specificity and a range of executive functioning tests.

Chapter 1: Depression and autobiographical memory specificity: A
systematic review of the role of executive functioning

Abstract

The role of executive functioning was reviewed in studies investigating reduced specificity of autobiographical memory in depression. Autobiographical memory refers to the remembered past events of a person's life (Conway, 2005). A finding often reported in the literature is reduced specificity of autobiographical memory in depression (van Vreeswijk & de Wilde, 2004) that is a reduction in producing rich information about the *who*, *what*, *where* and *when* of a remembered event. One cognitive process that has been implicated in this reduction is executive functioning. The aim of the current review was to explore whether executive functioning was implicated in the literature relating to reduced specificity of autobiographical memory and depression, and if so what explanations were given for this relationship. In addition, the review examined the implications for psychological assessment, formulation, intervention and future research. In order to investigate this, three electronic data bases (PsychINFO, Scopus and Web of Knowledge) were systematically searched identifying 191 articles that were reviewed. Of this initial figure, 9 studies met the inclusion criteria and were included in the systematic review. Of the studies reviewed there was a consensus of the importance of executive functioning in the depression/reduced specificity relationship, though the exact nature of this was unclear, and there were inconsistencies found. In addition, executive functioning appears to be important in the maintenance and course of depression and well as having implications for vulnerability to future episodes of depression. Explanations for this relationship were explored and discussed in terms of the importance for future research to study the inconsistencies discovered in these important finding and in impact on psychological assessment, formulation and intervention.

Autobiographical memory specificity and depression: A systematic review of the role of executive functioning

Depression is a disorder which has huge detrimental costs to both the individuals who are experiencing symptoms and on wider society economically and socially (Moussavi et al., 2007). Therefore depression justifies thorough and extensive research investigating all the parameters of its presentation in order to evidence and explain the aetiology, course and maintenance of the disorder. This section looks at the background work on depression and autobiographical memory specificity, before looking at work that links cognitive deficit in general and executive functioning in particular. This clarifies the objectives of the review. Continued research investigating the memory capabilities of individuals with a diagnosis of depression has several aims. It helps us to ascertain whether autobiographical memory specificity contributes to the onset of depression in people previously not depressed, whether specificity contributes to the onset of a new episode in previously depressed individuals and whether depression could be implicated in the onset of memory problems. In addition, research can investigate whether over-general memories seen in individuals with a diagnosis of depression act as a maintaining feature associated with the persistence of depression.

The review synthesises empirical research that has investigated the role of executive functioning on types and numbers of autobiographical memories recalled by people with a diagnosis of depression. This is critical for therapy as the basic premise of cognitive behavioural therapy relies on clients using their memory to reappraise situations in a more positive and realistic framework (Beck, 1993, Brewin, 2006). In addition other talking therapies such as psychotherapy, cognitive analytic therapy, solution focused etc involve shifting focus of memories from past events to the present moment. Thus understanding the cognitive mechanisms involved and any biases or changes that may be apparent in participants with a diagnosis of depression is crucial. Toth and Valentino (2008) highlight that it is important for therapeutic interventions to be informed by empirical

research investigating memory processes as well as grounded in evidenced based techniques. Indeed, empirical research investigating memory processes has much to offer the implementation of interventions.

Knowledge about the cognitive vulnerabilities of clients is crucial in enabling clinicians to undertake a thorough assessment. This knowledge can form the foundation of the factors involved in precipitating or maintaining low mood. It is imperative that interventions are driven and informed with a broad range of factors about a person's functioning both practically, emotionally, cognitively and structurally. Reduced specificity is related to delayed recovery from episodes of depression (Brittlebank, Scott, Williams, & Ferrier, 1993; Dalgleish, Spinks, Yiend & Kuyken, 2001). Research with participants with a history of depression who are currently in episode has also demonstrated reduced specificity (Mackinger, Loschin & Leibetseder, 2000). In addition reduced specificity has been related to a disruption in the ability to plan and imagine specific future events (Williams et al, 1996). This demonstrates the pervasive and potentially long term relationship between depression and functioning and the importance of conducting empirical research investigating a wide range of cognitive factors that can be used to inform assessment, formulation and intervention for people experiencing low mood.

Depression

The DSM-IV (APA; 1994, 2000) describes Major Depressive Disorder (MDD) as the most widely used diagnosis within the depressive disorders category. For a diagnosis to be made there must be a period lasting at least two weeks during which there is either a loss of interest in virtually all activities, or a depressed mood which leads to significant impairment in important areas of functioning such as occupational or social life. At least five of the following symptoms must also be present for a diagnosis to be made; weight changes (gain or loss) not due to diet; changes in sleep patterns; changes in psychomotor activity; loss of energy; feelings of guilt or worthlessness; difficulty in thinking, concentrating, or decision making; suicidal ideation or recurrent thoughts of death. A

diagnosis of MDD is not made if the symptoms meet the criteria for a mixed episode with both manic and depressive episodes occurring concurrently. A diagnosis is not made if the symptoms can be accounted for by bereavement (if symptoms do not persist beyond two months). This factor is changing with the DSM-5, however until it is published recent bereavement is an exclusion factor. This latest modification remains controversial. The psychological effects of a substance or a general medical condition are also exclusion factors. The episode is specified as either mild, moderate, severe without psychotic features, severe with psychotic features, in partial remission, or in full remission, and it is noted whether the episode is recurrent, or a first episode.

Much of the research investigating depression uses this DSM-IV criterion. However clinicians within the National Health Service (NHS) in the United Kingdom use the ICD-10 Classification of Mental and Behavioural Disorders (ICD-10) (WHO, 1992). The ICD-10 outlines 10 symptoms of depression with the number of symptoms defining the degree of depression. The identified symptoms are; persistent sadness or low mood; loss of interest or pleasure; fatigue/low energy; disturbed sleep; poor concentration; low self-confidence; poor or increased appetite; suicidal thoughts or acts; agitation or slowing of movements; guilt or self-blame. Mild depression represents four symptoms, moderate five to six symptoms and severe depression seven or more. There is a large amount of overlap between the two diagnostic frameworks. For the purpose of this review paper the term 'depression' is used to describe the cluster of clinical symptoms outlined in the DSM-IV as this is most widely used in research.

First episode depression occurs most commonly in the mid-twenties (Fava & Kendler, 2000) with average episode length from 4-6 months. Relapse rates are high with depression; 50% will go on to have future episodes and following a third episode the relapse rate rises to 90% (Kupfer, 1991). People with onset before age 20 and depression occurring in older adults have a greater vulnerability to relapse (Mitchell & Subramaniam, 2005). Depression is reported as the major cause of disability across the world (NICE, 2010). Murray, Lopez and Jamison. (1994) report that approximately 1.5 million disability-adjusted life years are lost per year in the West due to

depressive illness and Moussavi et al. (2007) highlight that the impact on physical health is greater in depressive illness than angina, arthritis, diabetes and asthma. This leads to a reduction in social and occupational functioning that has a detrimental effect on an individual's ability to work, leading to loss of employment, relationship difficulties and a worsening of depressive symptoms. Individuals with a diagnosis of depression are four times more at risk of suicide than the general population (Bostwick & Pankratz, 2000). The range of lifetime prevalence rates worldwide is between 4-10% (Waraich et al., 2004). Thomas and Morris (2003) estimated that the direct treatments costs of treating depression in the UK in 2000 was £370 million, morbidity costs a further £8 billion, and mortality costs £562 million. McCrone et al (2008) have predicted that in 2026 total cost of services for depression in the UK will stand at £3 billion and loss of employment due to depression will be £12.2 billion. Given these hugely detrimental effects of depression outlined, research investigating the structural cognitive processes involved is invaluable in informing assessment and formulation and then providing appropriate interventions that can support individuals to gain relief of the symptoms of depression and reduce vulnerability to future relapses.

Effects of depression on general cognitive processes

Researchers such as **Erickson et al. (2005)** have demonstrated that participants with a diagnosis of depression can display a range of cognitive deficits in basic attention and visual spatial functioning tasks. Austin, Mitchell and Goodwin (2001) conducted a review of the prevalence of cognitive deficits in depression. They found a prevalence of executive impairment and mnemonic difficulties. However they also called for more research into the effects of motivation, affect and wider cognitive functioning. Unsurprisingly, research has generally demonstrated that the more severe the depressive episode the greater the effects on cognitive functioning (Beats, **Sahakian & Levy**, 1996). However not all research had pointed in this direction, and some findings have been contradictory with no differences identified between participants with a diagnosis and those without. Austin et al. highlight difficulties in using and interpreting tests of cognitive functioning in

depression. Specifically they point out that many psychometric tests utilise a range of cognitive domains (memory attention, planning etc) making it difficult to isolate the specific mechanisms which might be influencing outcomes or differences based on mood. They point out that this is particularly salient for tests of executive functioning where the psychological construct is still understood at a relatively basic level.

Executive functioning

Executive functioning describes a series of cognitive processes and sub-processes such as planning, sequencing, task-switching, decision making (Elliot, 2003). The description does not represent a unitary concept but rather describes a series of higher order cognitive capabilities that require behaviour modification in the light of new information, sequencing complex action or generating complex strategies. Funahashi (2001) summarised executive function as a product of the co-ordination of various cognitive processes to accomplish a particular goal flexibly. In essence, executive functioning represents accomplishment of specific goals by flexibly co-ordinating sub-processes.

If the control, co-ordination or goal orientation focus of these systems breaks down at any point then behaviour becomes dis-inhibited, disjointed and poorly controlled. For example, individuals with damage to the prefrontal cortex, or with disruption to fronto-subcortical connectivity can show deficits in decision-making, organisation, planning and can exhibit impaired judgment. Individuals can remain unimpaired in focused tasks which rely on one function only, however the deficits can become apparent when co-ordination of a number of different higher order (executive) functions is required.

Autobiographical memory specificity

Autobiographical memory is one facet of the memory system, referring to the recollection of all the past events of a person's life that contribute to a sense of self (e.g., Conway, 2005; Williams et

al., 2007). Autobiographical memory is a form of episodic memory which is hierarchically organised in three levels; lifetime periods, general events and event specific knowledge (Conway & Pleydell-Pearce, 2000). A phenomenon often reported in the depression literature is reduced specificity of autobiographical memories (autobiographical memory specificity; AMS) in participants currently diagnosed with depression (Williams & Broadbent, 1986, van Vreeswijk & de Wilde, 2004, Williams et al., 2007). This describes the finding of difficulties in producing memories that include exact episodic experiences involving the *who*, *what*, *where*, and *when* of the remembered event. Instead, the literature reports that participants with depression produce overgeneral accounts of experiences (Williams et al., 2007). A standard way of investigating autobiographical memory empirically is to administer the autobiographical memory test (AMT, Williams and Broadbent, 1986). In this test participants are provided with a range of words and asked to produce specific events related to the words. The events must have lasted for a day or less and can either be a trivial or important event to the participant. A specific memory related to the cue word *happy* would be “I really enjoyed my birthday in Venice last month and felt really happy” whereas a general memory to this cue word would be “It’s nice when I feel happy”. The current review examines how autobiographical memory specificity has been investigated and particularly what role executive functioning has played in the process.

Explanations for reduced specificity in depression

Conway and Pleydell-Pearce’s (2000) self-memory system of autobiographical memory construction provided a building block to explanations for reduced specificity in depression. This model distinguishes generative (top down) and direct (bottom up) retrieval, where generative retrieval is a conscious intentional search through a hierarchy of memory representations to be matched against a set of retrieval specifications. Direct retrieval however occurs via internal or external contextual cues leading to activation of event specific knowledge. This type of retrieval is unconsciously activated and is experienced as unexpected recall in contrast to the effortful

generative retrieval. The production of overgeneral memories occurs due to dysfacilitation (Conway & Pleydell-Pearce, 2000) in the hierarchical retrieval process, which occurs before specific memories are created. This dysfacilitation occurs in participants with depression as the depressive illness disrupts the cognitive resources required to rapidly respond to cues required within the AMT.

A further theory - the affect regulation hypothesis (Williams, Styles & Shapiro, 1999) has been proposed to account for reduced specificity in individuals exposed to trauma. This proposes that an avoidant memory style is adopted in order that cognitions and thoughts related to trauma material can be avoided in attempt to reduce distress. Unfortunately this initially beneficial cognitive strategy of avoidance is then related to the development of post-traumatic stress disorder (Elhers & Clarke, 2000). This avoidant style however can be generalised beyond trauma related memories to broader domains leading to reduced specificity overall on tests such as the AMT. There are high rates of comorbidity between depression and trauma exposure (Breslau, Davis, Peterson, & Schultz, 2000) thus this is an important theoretical conceptualisation of reduced specificity.

An important paper by Williams (2006) proposed the CaRFAX model (Capture and rumination, functional avoidance, and executive control) a more integrative approach to further explain reduced specificity in depression that implicated rumination, functional avoidance and also executive dysfunction as important factors. This later model proposes that the self-memory system is an emergent and subordinate system that combines the autobiographical knowledge base with the working sense of self. Specific memories are created within this framework by higher level processes which mediate access to knowledge leading to the generation of a specific memory. Williams (2006) argues that the over general memory effect reported in depression is caused by three processes; capture and rumination, functional avoidance and executive control. Capture and rumination refers to self-relevant material that is subject to negative rumination, that is, reduced specificity from cue words in the AMT in memories that are related to long term schematic concerns (see Barnhofer, Crane, Spinhoven & Williams, 2007). These are similar to negative self-schemas (see

Beck, Rush, Shaw, & Emery 1979; Segal, 1988) and when activated on tests such as the AMT rather than helping the search process, such activation leads to individuals with a depressive thinking style to become 'captured' within the search process leading to the generation of general rather than specific memories. Functional avoidance proposes that participants avoid specific recollection as a protective mechanism to avoid affective disturbance. These two factors, in addition to reduced executive functioning influence the specificity of our memories by influencing behaviour and cognition either individually or in combination to affect autobiographical memory.

The theory explains the emergence of over-general memory in participants with a diagnosis of depression, however it could be argued that the theory has been overextended to such an extent that it has become a catch-all theory. In addition, while this account does provide a plausible account, the role of reduced specificity in depression is still not clearly understood. For example, Sumner, Griffith, and Mineka (2010) performed a meta-analysis to investigate how autobiographical memory specificity predicted the course of depression. They found that overall there was only a small relationship between reduced specificity and the course of depression ($r = -.1$) and reduced specificity and depression severity ($r = .13$). In addition, clinical status was not a significant moderator of the (very small non-significant) depression/specificity correlation. They did discover that fewer specific and more general/categorical memories did predict higher levels of symptomatology at follow up. The meta-analysis was only performed on 15 articles, however it does demonstrate that there is not a consistent picture emerging from the main body of research. In addition, Boritz, Angus, Monette and Hollis-Walker (2008) investigated the nature of autobiographical memory specificity in the context of the therapeutic course (beginning, middle and late therapy). They discovered that over the course of therapy participants' disclosure of single event autobiographical memories increased leading to a decrease of overgeneral memories. Crucially however, this was regardless of clinical outcome. Thus there were no significant differences between recovered and unchanged participants in terms of autobiographical memory specificity when therapy ended. Perhaps this reflects more that which occurs during the therapeutic

relationship as the client and practitioner get to know each other. That is, over the course of therapy, clients open up and recall more specific and less generic memories due to a shift in the therapeutic relationship rather than a shift in depression status. This has important implications for research as often studies are conducted in one off testing sessions where there no importance placed on building the type of rapport one would build within a therapeutic relationship.

The lack of consistent findings in the autobiographical memory/specificity association may also be related co-morbid factors such as trauma, grief, and rumination. There is reasonable evidence to suggest that we should investigate the specific causes of depression and not claim globally that depression is exclusively related to reduced specificity. For example, Boelen, Huntjens, van Dursen, and van den Hout (2010) looked at autobiographical memory specificity and complicated grief. Complicated grief is a disorder of grief that causes functional impairment characterised by preoccupation with the lost person, yearning, and intrusive images/thoughts (see Prigerson et al. 2009). They found no significant associations between measures of depression and autobiographical memory specificity. However, complicated grief was significantly associated with reduced specificity. In addition, Deeber, Hermans, and Raes (2009) discovered that brooding and rumination were related to reduced specificity, but not depression measures. Thus, they argue that rumination may act as a mediator in the AMS effect.

Howe, Cicchetti, and Toth (2006) have also argued that the findings in the literature related to reduced AMS in depression are far from clear. They discuss how it is equally plausible that the memory effects seen in individuals due to trauma and depression may represent motivational issues related to task completion or willingness to report memories rather than global memory deficits as a result of depression (also see Burt, Zembar, & Niederehe., 1995). Howe et al. (2006) raise specific points that are inconsistent with the idea of a global deficit of autobiographical memory specificity and depression. First, they point out that across studies, specific memories are reported over 50%, and often over 75% of the time in individuals with depression, or those who have been traumatised

(Dagleish et al., 2003). They also underscore the finding that individuals with depression tend to recall specific memories when they are cued with negative words. Overall, there is considerable evidence that depression does not inevitably lead to the inaccessibility of specific, autobiographical memories. Indeed, individuals with depression may have all too specific recollections, ones they perhaps unsuccessfully try to avoid.

Executive functioning and autobiographical memory

Executive functioning (EF) has been implicated in the presence of autobiographical memory generality in depression as a contributing factor to the phenomena (Williams, 2006). However there have been limited systematic reviews investigating the role of EF on the often reported relationship between reduced specificity of autobiographical memories and depression. Executive functioning describes the various higher order cognitive processes and structures that integrate and control other cognitive activities such as sequencing, planning and initiation. There is a growing body of evidence demonstrating that executive functioning is often impaired in depression (see Burt, Zembler, & Niederehe, 1995). Ellis and Ashbrook's (1988) resource allocation theory formed the building block of explanations for the role of executive functioning in reduced specificity of autobiographical memory. This proposes that low mood and depression lead directly to reduced executive functioning which then disrupts processes that would enable specific retrieval. Hertel and Hardin (1990) explained the process in terms of participants with a diagnosis of depression lacking initiative in cognitive tasks. Thus when individuals are provided with more information on the best way to complete a task, difficulties can be overcome. Conway and Pleydell-Pearce's (2000) model suggest that supervisory executive processes are involved in generative memory retrieval, thus when these processes are disrupted full memory search is not completed leading to an output that is over general as the search has fallen short of the target. Zacks and Hasher (1994) argue that reduced executive functioning leads to difficulty in inhibiting material that is interfering. In the Conway Pleydell-Pearce model, this would lead to difficulties in generative retrieval as inhibition of material

from other stages of the memory hierarchy is necessary. Roberts, Carlos and Kashdan (2006) have also demonstrated that participants with low mood were more likely to produce overgeneral memories in the latter half of a testing session suggesting that fatigue may be related to reduced executive functioning. Developmental studies have been consistent with the Conway Pleydell-Pearce Model with specific retrieval developing in the third or fourth year once more higher level conceptual categories have begun to develop (Fivush & Nelson, 2004). In addition studies investigating older adults with impaired working memory capacity display difficulties generating specific memories (Winthorpe & Rabbitt, 1988). Williams et al. (2006, 2007) suggest that research highlighting the role of executive functioning can help to pinpoint the sub process within generative retrieval that may be implicated in the phenomena of reduced specificity of individuals with a diagnosis of depression.

Objective and review questions

The main objective of the current review was to investigate the literature relating to depression, autobiographical memory specificity and executive functioning. The purpose was therefore to synthesise the literature relating to EF and to investigate more thoroughly how it is implicated in autobiographical memory specificity and depression. To evaluate this, those articles which investigated differences in executive functioning in relation to depressed mood and autobiographical memory were reviewed.

In particular the following 4 questions were posed of these articles;

- 1) Is executive functioning implicated in the often reported finding of reduced specificity of autobiographical memory in depression?
- 2) What explanations are offered for the relationship?
- 3) What are the implications for psychological assessment, formulation, interventions in reducing future vulnerability to depressive episodes?

4) What are the implications for future research?

Investigating memographical phenomena such as reduced specificity can aid our understanding of depression both theoretically in terms of structures and processes involved as well as clinically in terms of our approach to assessment, formulation and therapeutic interventions. Understanding the maintaining features of such phenomena can help us devise interventions that can reduce vulnerability to future episodes (Raes, Hermans & Williams, 2009).

Method

Literature search

Publications used in the review were extracted from PsycINFO and Scopus (2000-2012) and Web of Knowledge (1990-2012) using the key words 'autobiographical memory specificity', 'over general memory', 'depression', 'low mood' and 'executive function'. Following retrieval of potential publications the abstracts, method section and references were reviewed in order to apply the exclusion criterion. Publications were excluded if the content focused specifically on any of the following; acquired brain injury, adolescence, anorexia, autism, borderline personality disorders, bipolar disorder, children, cognitive impairment, eating disorders general, electro convulsive therapy, hypnosis, post traumatic disorder, schizophrenia/psychosis or stroke/cerebral infarction. The author was not blind to author name, journal or institution. The review also excluded non empirical papers such as review papers, meta analyses and theoretical papers. Figure 1 demonstrates the search strategy used to select publications for the review.

Quality assessment

Studies selected based on the above methods and criteria were evaluated for methodological quality and rigour. Randomised controlled trials (RCT's) are seen as the best design for inferring causality however they have not been conducted in the area of autobiographical memory specificity, depression and executive functioning. It is unlikely that RCT's will be conducted

in this area of research in the future due to the theoretical rather than applied nature of the research. This type of research attracts funding from an educational viewpoint but does not attract the level of funding required to conduct RCT's. Studies that represented a sound experimental design with the use of high degree of study controls, lengthy efforts to reduce extraneous variables and reliable and valid measures were deemed to be of good quality. Studies were further quality assessed by using the criterion developed by Kmet, Lee and Cook (2004) for evaluating primary research papers in a variety of fields. This is a 14-item checklist which provides a replicable, systematic and quantitative way of assessing the quality of research over a broad range of domains. It enables researchers to identify papers for systematic reviews that are of high quality representing sound empirical research. It evaluates studies based on description of objectives, study design, participant descriptive, allocation description, measure description, appropriateness of sample size and description of analytic methods, the presence of reported variance results, evidence of control for confounding variables, sufficiently reported results and finally evidence that conclusions are based on results. All the papers selected for inclusion in the current review paper met the above criteria sufficiently to be deemed of good quality.

Data synthesis

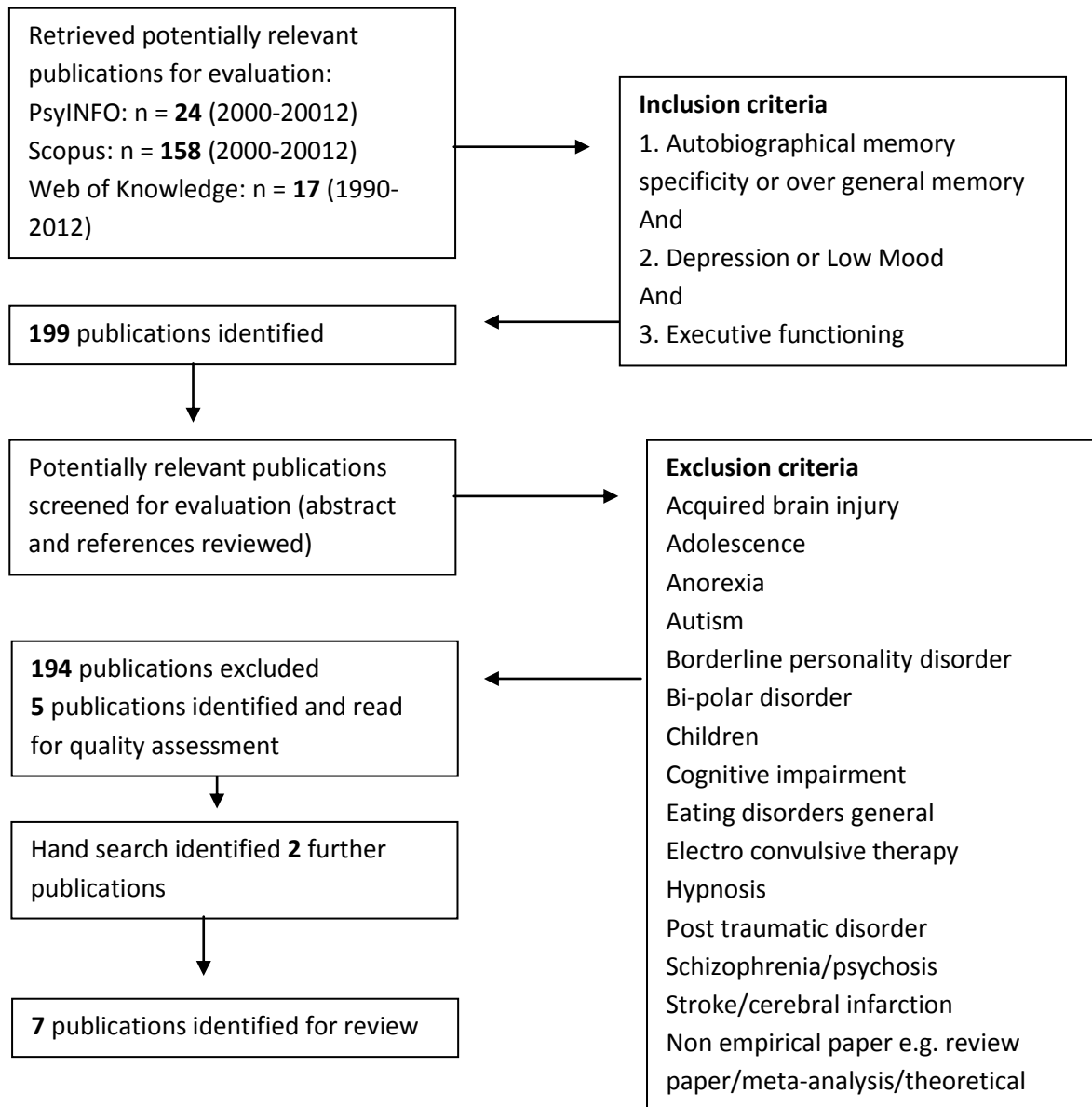
Quantitative analysis was not performed on the effect sizes in the publications due to the heterogeneity of the study population however systematic methods were applied to the identified papers. The information was synthesised and is presented in table 1.

Data identification

Figure 1 summarises the recruitment process. One hundred and ninety nine articles were identified via the electronic databases outlined above. These were initially screened for quality and according to the inclusion and exclusion criteria. One hundred and ninety four articles were excluded at this stage leaving five papers from the initial search; Barnhofer, Crane, Spinhoven and Williams; 2007, Dalglish et al.; 2007, Raes et al.; 2006, Spinhoven, Bockting, Schene, Koeter, Wekking and Williams; 2006, Yamamoto and Shimada; 2012. The Dalglish et al. paper contained 8 studies of

which studies 2, 3 and 7 were relevant to AMS, depression and EF thus these studies are reported separately in the review. A further two papers were identified via hand search of related and relevant papers: Birch and Davidson; 2007, Holland, Ridout, Walford and Geraghty; 2012. Thus nine studies were systematically reviewed.

Figure 1. Flow chart of publication selection for review.



Results

Participants

Across all studies there were 421 participants in total, including controls. Participant numbers ranged from 23-159. In four of the studies participants were recruited from non-clinical samples, three studies used participants described as previously depressed, one with participants 'depressed according to clinical judgment' and one with participants who met the criterion for MDD. The SCID was used as a diagnostic tool in three studies, the other six studies used measures to indicate mood rather than for diagnostic purpose. The BDI was used in six studies; the HRSD was used in one study, the geriatric depression scale used in one study and the HADS used in one study. Six studies used just one mood indicator, three studies used two or more tools.

Empirical focus

All studies adopted an experimental methodology with a range of within/between factors. Eight studies used the AMT as a primary outcome measure to measure specificity. One study (Yamamoto & Shimada, 2012) used the Ray auditory and verbal learning task and its empirical focus was overall memory performance not autobiographical memory. It was included however due to its empirical focus on mood, memory and executive functioning.

General findings

See Table 1 for a summary of the main findings. Barnhofer, Crane, Spinhoven and Williams (2007) reported that in previously depressed participants specificity of autobiographical memory could be predicted by dysfunctional attitudes related to need for approval and performance evaluation (see also Beck 1967, 1976). They also discovered that the content of the material used was particularly relevant when cognitive control was undermined.

Birch and Davidson (2007) found a reduced specificity in autobiographical memory effect in depressed participants and discovered that specific memories were positively correlated with measures of working memory but not IQ generally.

Conversely, in a non-clinical sample, Dalgleish et al. (2007, study 2) found that specificity was not correlated with any of the measures of executive control used in their study. However in study 3 they discovered that on a different test of executive functioning (number generation task) specificity was reduced. Study 7 in the Dalgleish et al. paper reported an association between reduced specificity and depressed mood particularly under conditions of high cognitive load, measured via a digit span recall task.

Holland, Ridout, Walford and Geraghty (2012) found that for neutral cues (not positive or negative) younger adults recall more specific memories than older adults. They also identified a tendency for older adults to focus more on positive material that was not influenced by age related variance in executive functioning.

Raes et al. (2006) identified a relationship between poor working memory/central executive functioning and source memory and concluded that rumination was related to both. They also highlight the link between voluntary retrieval of specific memories and central executive processes.

Spinhoven, Bockting, Schene, Koeter, Wekking and Williams (2006) replicated previous studies that have identified reduced specificity of autobiographical memories in participants with a history of depression. They argue that this provides support for the presence of a global cognitive impairment, but one which does not necessarily lead to future vulnerabilities. However, given that relapse rates are so high it could be a factor.

The final study by Yamamoto and Shimada (2012) did not specifically address autobiographical memory, however linked impairment on both general memory tests to previous history of depression.

Role of executive functioning

A range of different tests of executive functioning were used across the nine studies. This included divided attention tasks, Key pressing task, letter number sequencing, verbal fluency, design fluency, block design test, Porteus maze test, number generation task, digit span forward/backwards

(WAIS-III), Stroop colour-word task, trail making test (D-KEFS), task management, planning and monitoring (BADS).

Five studies concluded that executive functioning is implicated in the study findings, two an indirect relationship and two a partial relationship. Barnhofer, Crane, Spinhoven and Williams (2007) conclude that under conditions of high cognitive load participants recall fewer specific memories. In addition, in previously depressed participants when cognitive control was undermined dysfunctional attitudes predicted specificity. Dalgleish et al. (2007) study 3 also found that executive functioning was related to reduced specificity of autobiographical memory in a non-depressed non clinical population. Study 7 by Dalgleish et al. reported that increasing cognitive load was associated with fewer specific memories. Although the study was conducted with a non-clinical sample mood was assessed and a relationship discovered between mood and increasing cognitive load which further added to reduced specificity. Raes et al. also discovered a relationship between poor executive functioning and reduced specificity of autobiographical memory. This was with a sample who met the criterion for MDD, however they did not use a comparison control group so it is difficult to ascertain the specific role of depression. Yamamoto and Shimada (2012) concluded that in participants previously diagnosed with a MDE, this experience may have a persistent negative influence on a range of cognitive functions including executive functioning.

Two studies reported an indirect relationship of executive functioning on autobiographical memory specificity. Birch and Davidson (2007) found a decrease in autobiographical memory specificity in participants with a diagnosis of depression. They also found a positive correlation between specific memories and working memory generally but not executive functioning. Holland, Ridout, Walford and Geraghty (2012) found that younger adults produced more specific memories than older adults and that this was related to executive functioning tested via a number generation task. However they concluded that this represents differences attributable to age rather than executive functioning per se.

Two studies reported no direct relationship but a partial one between executive function and autobiographical memory specificity. Dalgleish et al. (2007) study 2 found no relationship between specificity and executive functioning, however post hoc analysis indicated that error rate on the executive functioning test may be related to specificity. Spinhoven, Bockting, Schene, Koeter, Wekking and Williams (2006) found reduced specificity in participants with a history of depression, however found no correlation between specificity and the stroop task.

Table 1. Summary of studies investigating autobiographical memory specificity in depression and executive functioning

Authors, Year	Participants			Empirical focus						Study quality	
	N	Mean Age (SD)	Type	Diagnostic tool	Method	Materials	Findings	EF test	Is EF implicated? (direct/partial/indirect)	Control	Replicability
Barnhofer, Crane, Spinhoven & Williams (2007)	35	32 (12)	16 previously depressed 19 never depressed Not in current episode	SCID, BDI- II	Experimental mixed design	AMT, dysfunctional attitudes test	In previously depressed participants dysfunctional attitudes predict specificity. Content effects seen when cognitive control is undermined.	Divided attention concurrent with AMT Key pressing task	(Direct) Yes under conditions of high cognitive load fewer specific memories. Small effect size however possibly due to easy task.	Yes	Good
Birch & Davidson (2007)	17 depressed 17 non depressed	72 (5)	'Depressed according to clinical judgment'	Geriatric depression scale		AMT	Reduced specificity in depression. Specific memories positively correlated with measures of working memory but not IQ.	Letter number sequencing	(Indirect) Not specifically – working memory but not EF	Yes	Poor due to loose diagnostic criterion

Dagleish et al. (2007) Study 2	24	40 (9)	Non depressed	BDI	Experimental within participant	AMT	AMS did not correlate with any of the measure of executive control	Verbal fluency, design fluency, block design test, Porteus maze test	(Partial) Error rate implicates executive functioning	No	good
Dagleish et al. (2007) Study 3	24	35(11)	Non depressed	BDI	Experimental within participant	AMT	Reduced specificity was associated with more errors on the number task.	Number generation task	(Direct) Breakdown in inhibition on EF task related to reduced specificity	No	Good
Dagleish et al. (2007) Study 7	23	34(14)	Non clinical sample self reported mood	BDI	Experimental within participant	AMT	Depressed mood related to reduced specificity particularly under conditions of high cognitive load.	WAIS-III digit span	(Direct) Increasing cognitive load led participants to produce fewer specific autographical memories.	No	Good

Holland, Ridout, Walford & Geraghty (2012)	25 young adults 21 older adults	21 (5) 70 (11)	Non clinical sample	HADS	Experimental between participant	AMT	Younger adults retrieved more specific memories than older adults for neutral cues only. Emotional processing of positive material is not influenced by age-related variance in executive control.	Random number generation task	(Indirect) Younger adults performed better on the NGT and produced more specific memories. Implies age rather than EF directly.	Yes But not mood	No
Raes at al. (2006)	26	39 (10)	Meet criterion for MDD	SCID, HRSD	Experimental	AMT (extended)	Reduced specificity related to poor working memory (central executive functioning) and poor source memory. Rumination also related to both.	Forward digit span & letter-number sequencing (from WAIS-III), verbal fluency, auditory verbal learning	(Direct) Fewer specific memories related to poor executive functioning	No	Good
Spinhoven, Bockting, Schene, Koeter, Wekking & Williams (2006).	122 MDD 37 contr ol	44 (9)	Have met criterion for MDD, 2 episodes in last 5 years but not currently in episode	SCID-I, MINI, HRSD, BDI,	Experimental between participant plus longitudinal pre-post therapy analysis	AMT	Reduced specificity in previously depressed participants. Also associated with age and education. Suggest it may reflect a global cognitive impairment but not a future vulnerability.	Stroop colour-word task, digit span.	(Partial) No correlation between stroop task and specificity	Yes	Good

Yamamoto & Shimada (2012)	50	22 (5)	17 previously diagnosed with MDE, not currently in episode	BDI-II	Ray auditory verbal learning task (verbal learning and memory) Not specifically autobiographical memory	Previously depressed participant impaired on memory tasks generally, specifically divided attention but not tests of executive functioning. No finding in relation to autobiographical memory specificity.	Verbal fluency test trail making test, task management, planning and monitoring from BADS.	(Indirect) Experiencing MDE may have a persistent negative influence of cognitive functions such as divided attention which requires executive functioning.	No	Yes
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Discussion

The current review aimed to investigate: 1) whether and how executive functioning is implicated in the often reported finding of reduced specificity of autobiographical memory in depression, 2) explanations offered for the relationship, 3) implications for psychological assessment, formulation, interventions in reducing future vulnerability to depressive episodes, and 4) implications for future research. To explore these points, nine studies were identified and selected for inclusion. This is a relatively small number of studies. The number would have been vastly larger if the focus was on the broader topic of autobiographical memory specificity. There has been a huge increase in the investigation of cognitive processes involved in memory and in particular autobiographical memory. However the scope of the review was to explore the relationship between executive functioning and the production of specific autobiographical memories which led to a much smaller number of papers fulfilling the inclusion criteria.

The literature reviewed demonstrated a relationship between executive functioning and autobiographical memory specificity in several ways. Five of the studies concluded that executive functioning was directly implicated, two indirectly and partial links were found in two others.

Barnhofer et al. discovered that reducing executive capacity by introducing a secondary task increases retrieval failures. They argue that executive capacity affects autobiographical memory specificity via two mechanisms. Firstly reducing executive capacity undermines general performance leading to increased random error. In addition the impact of interference leads to latent vulnerability factors such as dysfunctional attitudes influencing memory retrieval. They claim that dysfunctional attitudes that influence depressed mood lead individuals to interpret their own autobiographical memories as more self-discrepant. In order to maintain self-coherence therefore individuals with a depressive thinking style produce more thematically related and general memories (Conway et al. 2004). In addition they conclude that dysfunctional schemata are highly over rehearsed and generic, thus if the schemata are activated during memory searches, it is very difficult to inhibit. Barnhofer et al. also argue that undermining executive capacity also increases

content effects such as mood congruence. This explanation is consistent with Dalgleish et al. (2007). They summarise that cognitive control plays an important role in the characteristic memory deficits often seen in depression in that reduced executive functioning may interact with schemata. They also argue that this may be implicated in the maintenance and reoccurrence of depressed mood. It is important to note however that participants in the Barnhofer et al. study were not in a current mood episode but had been previously depressed. This may indicate a link with relapse.

Birch and Davisson (2007) concluded that greater working memory capacity led to increased specificity of autobiographical memory. However they also discuss decreased working memory capacity does not fully account for reduced specificity. They argue that there may be other factors that are under more conscious awareness such as efforts to avoid material that is distressing to them that may account for a degree of specificity. A great limitation of the study was the lack of formal diagnosis of participants so all conclusions about the relationships with depression must be made with this consideration.

Dalgleish et al.'s paper compiling a series of 8 studies systematically manipulating the parameters of the AMT provided support for the idea that reduced specificity of autobiographical memory in depressed mood states could be accounted for by reduced executive functioning. They propose three explanations for why this might be the case. The first surrounds the idea that depression is related to a deficit in inhibiting distracting information leading to a lower level of activation of the conceptual representations. The second explanation they offer suggests a difficulty in holding in mind all the goals of the task (Engle, Tuholski, Laughlin, & Conway, 1999). That is, decreased executive functioning means that participants are not able to retain all the information to recall the memories and make them specific too. Here, specific memories are not inaccessible however the secondary goal of making the memories more specific is sacrificed to attend to the primary goal of producing autobiographical memories. The third explanation they propose is that automatic and controlled processes are utilized differently in depression (Barrett, Tugade, & Engle,

2004). In this explanation, participants may have unsuccessful attempts at controlled processing so learn to adopt automatic processing in cognitively difficult tasks which leads to over general memories. Again, specific memories are not inaccessible however a protective cognitive strategy is adopted based on prior learning which leads to reduced specificity. Clinically, if executive functioning of clients is compromised, their ability to engage in therapies such as cognitive behavioural therapy may be compromised. This is not a counter indication for CBT, however clinicians need to be aware that clients may have deficits in this area and make allowances accordingly. For example clinicians can decrease the cognitive load of tasks by providing clear step by step instructions, not overloading clients with information, and being repetitive, pacing the intervention appropriately, reviewing regularly, summarising the sessions for the client and asking for feedback. In addition, psycho education about the relationships between mood and executive functioning would be useful in enabling clients to understand the processes occurring and the effect it can have on their mood.

Dalgleish et al. discuss the reasons why depression might lead to lowered executive functioning in the first place. They suggest that task irrelevant thoughts and ruminative processes interfere with controlled attention. Watkins and Teasdale's 2001 study demonstrating that experimentally manipulated rumination can lead to reduced specificity supports this proposal.

Holland, Ridout, Walford and Geraghty (2012) conclude that there are age related differences in autobiographical specificity. That is, they found that younger adults were able to produce more specific autobiographical memories than older adults. This was also related to decreased executive functioning. However they found that this effect was not present for positive material in older adults, thus they concluded that emotional processing may act as a buffer against the detrimental effects of poor executive functioning on autobiographical memory specificity.

Raes et al. (2006) found that over-general autobiographical memories were related to executive functioning even when depression severity was controlled for. They found that specificity was not related to performance on other memory tasks measuring semantic memory and episodic

memory. This indicates that over-general autobiographical memory is not merely a linear relationship related to depression but that executive functioning is an important issue to factor into the relationship. As with Dalgleish et al. they propose that rumination may be an influencing factor (Rampone, Barnard & Nimmo-Smith 2004). They argue that the verbally based thinking style in rumination leads to disruption to a search hierarchy leading to the memory search being blocked at an intermediate stage before specific memories are retrieved. Correlation analysis of the data was performed however so interpretation must be done in terms of a relationships rather than assuming causality. This is consistent with the CaRAFAX model (Williams, 2006).

The Spinhoven et al. (2006) study afforded the opportunity to study autobiographical memory specificity in a population of participants who had previously been depressed but were not currently in episode. This means that cognitive processes can be investigated without concurrent symptomatology. They discovered that between episodes reduced specificity could also be identified in previously depressed participants. They claim therefore that reduced specificity is not specific to a depressed state and is a characteristic of remission too. They also demonstrated that age and education were important factors in autobiographical memory specificity thus highlighting the importance of matching controls on these facts when conducting empirical research. When age and education were accounted for they still identified a relationship between executive functioning deficit and reduced specificity of autobiographical memory. While Spinhoven et al. did find correlations between autobiographical memory specificity and tests of immediate and delayed recall, they did not discover any positive associations between specificity and the Stroop task or the digit span forwards/backwards tasks. This suggests that more in-depth studies are necessary investigating different parameters of executive functioning with other tests, and in particular its role in relapse.

Yamamota and Shimada (2012) used a range of neurological tests of memory, attention and executive functioning to investigate more fully the relationships between these domains of

functioning and the period of remission following a major depressive episode. They discovered that of the range of assessments used, deficits in tests of divided attention were more marked in previously depressed participants compared to controls. This effect was seen even after age, medication status and mood characteristics were accounted for. Tests of divided attention require higher order cognitive functions to be engaged and may explain some of the difficulties in organising and planning everyday life that people with a history of depression can experience. Somewhat contradictorily to previous research Yamamoto and Shimada found no differences in tests specifically tapping executive functioning, although tests of divided attention do require executive functioning. They explain this contradictory finding in terms of age differences between their clinical sample and comparable studies as their participants were much younger. One major limitation of this study is the lack of information on education of participants as previous studies have demonstrated the importance of intelligence on higher level cognitive functions such as executive functioning.

Although not investigating autobiographical memory specificity, Castaneda et al. (2008) discovered that a sample of young adults diagnosed with depression were only mildly impaired on a verbal learning task (the California Verbal Learning Test, or CVLT; Delis, Kramer, Kaplan, & Ober, 1987). They concluded that the earlier the age of onset of depression, the higher the level of cognitive impairment. Importantly, it may not be the age of onset that is the key. Rather, it may be the length of time the individual has been depressed for.

Implications for practice/therapy

The recommendations for psychological assessment, formulation and intervention outlined below represent a small piece of the larger picture of cognitive deficits and their relationship with mood as this was the focus of the current review. It is also just one small part in the larger picture of memory processes and depression. However it adds a valuable contribution to the wider body of knowledge in the area.

The findings of the Barnhofer et al. (2007) study indicate that reduced executive control may be implicated in the maintenance and reoccurrence of depression. Thus they argue that interventions should focus not only on challenging dysfunctional attitudes but also on increasing executive capacities and educating individuals about how lapses of executive control may lead to cognitive patterns and schemata that lead to over generalisation which in turn can maintain depressive thinking styles. Psychoeducation about the impact of depressive thinking style therefore can help clients understand some of the factors maintaining low mood.

Dalgleish et al. (2007) explain further that executive functioning may interact with depressive schemata. Therefore interventions should encourage clients to reduce distractions that would increase cognitive load when completing tasks. In addition identifying the depressive schemata and understanding that when cognitive load is compromised this might lead to over general accounts can help clients to begin to spot when they might be vulnerable. In addition, Dalgleish et al. discuss how clients with a diagnosis of depression may have difficulty in inhibiting distracting information due to reduced executive functioning further evidence for the beneficial effects of reducing distractions and providing practical ways to lessen cognitive load.

Holland et al. (2012) suggest that interventions that focus on encouraging older adults to engage in greater emotional processing may be beneficial in depressed mood. In addition they highlight the importance of the valence of the material. Clients can be provided with information about mood congruence; the potential vulnerability for people with low mood to process negative information differently from participants without low mood and the role this plays in maintaining depression.

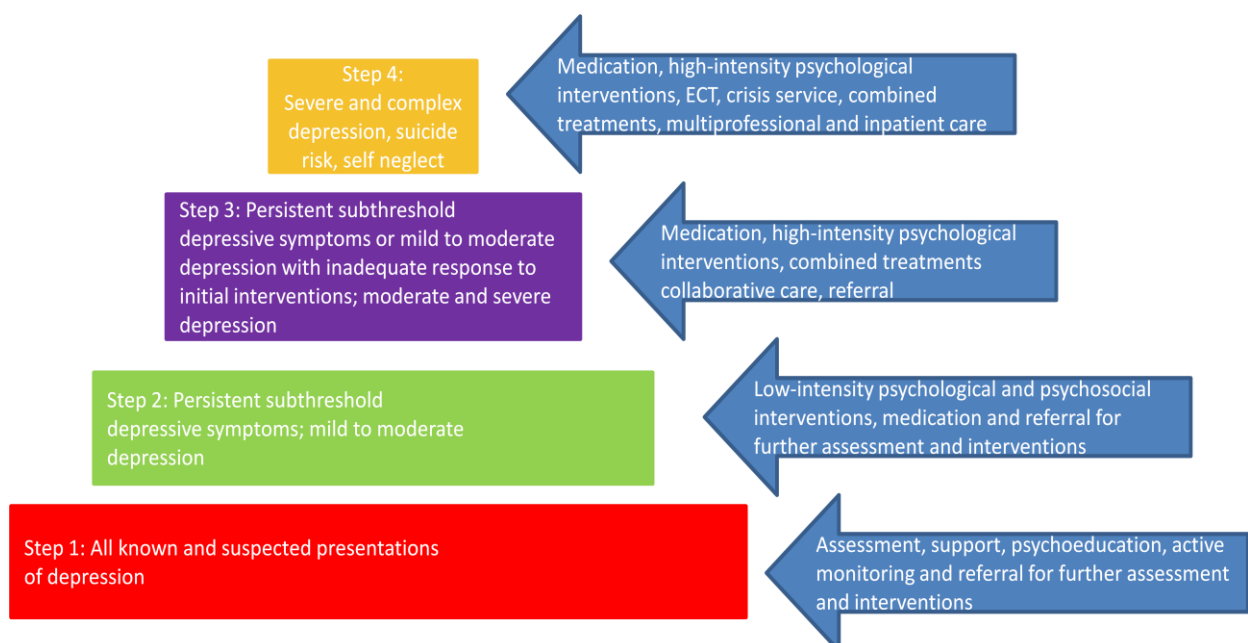
Raes et al. (2006) found that executive functioning was also compromised in individuals who were not currently exhibiting depressive symptoms, but who had previously been depressed. They argue that this reduced functioning serves as a vulnerability factor to future depression, therefore reinforcing the usefulness of decreasing cognitive load in difficult tasks for not only currently

depressed individuals but also for those with a history of it in order to attempt to minimise future episodes.

Yamamota and Shimada (2012) suggest that using measures of executive functioning as part of a full assessment may be a useful tool to evaluate cognitive impairment and vulnerability to future depressive episodes. As with other studies, they suggest that conversely using strategies to develop cognitive and executive functioning may serve as a useful intervention in depressed mood. The finding of difficulties in tests of divided attention in previously depressed participants (Yamamoto & Shimada, 2012) has implication on therapies such as meta-cognitive therapy (Wells and Matthews, 1994) as deficiencies in higher level cognitive processes will impact on clients ability to engage in metacognition.

There are specific examples of how this body of literature can contribute to the implementation of specific therapy modalities for clinical psychologists. In the UK the National Health Service works within a stepped model of care providing National Institute of Clinical Excellence (NICE) recommended services and interventions. See figure 2 for the stepped model of care pathway for depression

Figure 2: Depression stepped model of care CG90 Depression in adults: NICE guidance (2009, updated 2013).



As can be seen in figure 2 the first step in addressing depressive symptoms is assessment. Based on the literature reviewed in this paper, there is good evidence to suggest that executive functioning could be an extra assessment tool within the depression battery. This would provide rich information about people's capacity to encode information and an indicator of their general level of cognitive functioning. In addition as tests for executive functioning do not specifically address symptomatology it could be a more subtle and implicit way to measure broader difficulties related to depression. This would also provide information about the level at which to pitch psychoeducation at step 1, particularly if executive functioning has been compromised, and how to pace low intensity interventions at step 2. For example clients may not remember the details of information provided about sleep hygiene therefore step by step instruction on how to create better conditions for sleep would be sufficient to reduced cognitive load (Espie, 2006). Low intensity CBT (individual, group and computerised) can also be provided in a way which reduces cognitive load and can provide information about a) the potential effects of depression on cognitive functioning and b) the specificity of memory recall and how it may act as a vulnerability factor for future episodes. Physical activity programmes provided at step 2 can also benefit from knowledge surrounding the potential effects of depression on cognitive functioning and break instructions down into more simple steps. Small successes can begin to improve mood, however as inability to follow instructions can also feed negative maintenance cycles thus maximising the chance of success can have a very positive effect on depression (Carr & McNulty, 2010). Severity of depression appears to be related to decreased executive functioning (Burt, Zembor & Niederehe, 1995). Thus as clients move up the stepped care model, clinicians need to be more vigilant to the effects of reduced executive functioning.

At step 3 clients are offered CBT and interpersonal therapy (IPT). The premise of CBT is that problematic lesions are learned early in life due to stressful life events which lead to maladaptive schemas (Beck 1976). These negative schemata lead to cognitive distortions and negative automatic thoughts which precipitate and perpetuate low mood and depression. The focus of therapy

therefore is to allow clients to monitor their mood changes and link these mood shifts to situations and automatic thoughts activated by the situation. Clients can then develop more realistic and positive appraisals of events and check the validity and reality of their negative automatic thoughts and schema. Over time this process enables mood to lift and for clients to see themselves as worthy worthwhile individuals in control of their own mood state. Various strategies are utilised in order for clients to get to this place, where they have mastery over their low mood. All of these strategies can benefit from the knowledge of the link between executive functioning and mood as all the homework and activities in CBT (scheduling pleasant events, cognitive restructuring, self-monitoring, modifying negative cognitions, etc) require focused attention and higher order cognitive processing. If cognitive functioning is impaired then ability to engage in these activities will be compromised. Again, clear descriptive instructions that increase the level of processing for clients will help to counter effects of reduced functioning and allow clients to engage with the material that will help to break their depressive maintenance cycles and lift their mood. In addition, information to clients about the vulnerability to produce over-general memories can help protect against the effects of this.

IPT is the most validated form of psychodynamic therapy (Weissman, Markowitz & Klerman, 2000) and is based on the work of Sullivan (1953). The theory recognises that there are a range of different factors that lead to depression, but argue that interpersonal difficulties are central in the development and maintenance of low mood. The theory argues that relational issues are related to depression due to four interpersonal difficulties, grief, role disputes, role transition and interpersonal deficits. In order to address these problem areas strategies such as exploratory techniques, clarification, communication analysis, use of the therapeutic relationships, techniques to change behaviour and encouraging effect are used. As with the strategies employed in CBT, clinicians working with techniques in IPT can improve the efficacy of the intervention if thought is given to the levels of executive functioning a client is presenting with and modifications to these

techniques made. At steps 3 and 4, psychologists offer high-intensity psychological interventions which can benefit in all the same ways as above.

Third wave therapies (see Haynes, 2004) such as mindfulness based CBT (MBCBT) and compassion based therapies (Gilbert, 2010) can also benefit from the impact of executive functioning on depression. MBCBT is derivative of Jon Kabat-Zinn's mindfulness based stress reduction programme (1990, 1994, 1998) developed by Segal, Williams and Teasdale (2003). The goal in MBCBT is for clients to become aware of their negative thoughts and feelings in order to develop ways of responding to these thoughts and feelings and to disentangle these thoughts from ruminative depressive processing (Teasdale et al, 2000). In CBT the focus is on changing negative thought processes, however in MBCBT the goal is to change the relationship to, and awareness of the content of these thoughts. Mindfulness practices are the main tool by which clients are taught to become more aware of their thought processes and feelings and to then view them from a detached, decentred position. The evidence base for MBCT for recurring depression is looking very promising (Segal, Williams & Teasdale, 2003). Clinicians working with MBCT need to be aware of the body of literature on executive functioning and depression. Reduced levels of executive functioning may have a detrimental effect on ability to begin to engage with mindfulness techniques, however mindfulness practices are an excellent way of focusing the mind and reducing internal and external distractions in order that clients' can then engage with more cognitive demanding tasks. The same also applies to compassion based approaches developed by Gilbert (2010). Compassion based therapies underscore the way in which developmentally we often develop un-compassionate and uncaring ways of relating to ourselves. Gilbert argues that developing compassionate and kind ways of being develops self-confidence, creates meaningful relationships, and promotes good physical and mental health reducing vulnerability to depression. Understanding how our autobiographical memory contributes to our sense of self is central to this theory and knowledge on executive functioning would improve clinicians' ability to work with clients effectively.

Limitations and implications for research

It is important to emphasise that the papers discussed in the current review represent a very small selection of articles relating to executive functioning of the wider literature investigating autobiographical memory and depression. Any conclusions drawn must therefore take this into account. Due to the heterogeneity of the study population, quantitative analysis was not performed on the effect sizes of the publications used in the systematic review. If the study focus had been wider than executive functioning then there would have been scope for quantitative analysis. This should be considered for future review papers.

Dalgleish et al. point out that their comprehensive study was conducted with a subclinical population. They therefore call for research to be conducted with a wider range of mood conditions and to investigate more fully which aspects of executive functioning are more or less affected by depressed mood. In addition, there were a range of different tools used to ascertain depressive symptoms across the different studies. It will be important for researchers to come to a consensus about the most appropriate tool to use in order that research papers are not reporting findings based on inconsistent measures.

Yamamoto and Shimada (2012) discovered a contradictory finding where they were able to identify no differences in tests of executive functioning between participants with and without a history of depression. They explained this in terms of their sample being much younger than in previous studies suggesting an age/executive functioning interactions. This certainly calls for more research to be conducted with a younger sample of participants.

Summary

The current review has demonstrated that executive functioning plays an important role in the depression and reduced specificity relationship. However it is still not clear how widespread this is and how executive functioning interacts with other factors to create reduced specificity. Continued research is necessary to expand the range of executive functioning tests used, utilising participants with a current diagnosis of depression in order to further investigate specificity, mood

and executive functioning. In addition it will be important to attempt to design material that elicits greater specificity of autobiographical memory in order to test whether differences found between participants with and without current depressive symptoms represents a global deficit or an artefact of the testing process. This is important given the inconsistencies found in previous literature.

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Chapter 2: Empirical paper – Depression, autobiographical memory
specificity and executive functioning

Abstract

Using a modified autobiographical memory test (AMT) this research was designed to elicit greater levels of specificity in the autobiographical memory of participants with a diagnosis of depression. This version of the AMT consisted of words rated highly for concreteness, imaginability and specificity and was used in addition to the traditional AMT designed by Williams and Broadbent, (1986). Finding greater specificity in a modified test would indicate that depression does not necessarily lead to reduced specificity as previous work has found (Williams & Broadbent, 1986). The paper also explored the relationship between specificity and executive functioning with the modified AMT as previous findings may have been due to research tools either as an artefact of the testing situation or produced as a defensive effect. The trail making test from the D-KEFS (Delis, Kaplan & Kramer; 2001) was used to investigate executive functioning. In total, 60 participants were included, 30 with a diagnosis of major depressive disorder and 30 controls matched on age, gender and education status in a 2 x 2 x 2 mixed design. Results demonstrated four findings of significance: 1) while there was a replication of previous literature where participants with a diagnosis of depression recalled significantly fewer specific autobiographical memories than matched controls, when executive functioning was run as a covariate this effect disappeared on the modified AMT but remained on the traditional AMT. 2) participants with a diagnosis of depression recalled significantly more general memories than matched controls on the traditional AMT (another replication) however there was no difference in number of general memories recalled on the modified AMT. 3) For both the traditional and modified AMT there was a mood congruence effect. That is, participants with a diagnosis of depression and current low mood recalled fewer positive specific autobiographical memories. Finally 4) higher levels of executive functioning were correlated with greater specificity of autobiographical memory regardless of depression status. The results are discussed in terms of the implications for theory in addition to the clinical issues in terms of assessment, formulation, and implications for interventions. In addition implications of the findings

on our knowledge of the course of depression are discussed in terms of methods of enhancing executive functioning to reduce vulnerability to future episodes.

Autobiographical memory specificity, executive functioning and depression

Several factors addressed in this study are introduced in turn for clarity. Firstly, the relationship between depression and autobiographical memory specificity is discussed. The findings in this area are inconsistent and related partly to methodological features, in particular mood congruence and cue words used. One feature which is emerging from the literature however is the role of executive functioning, its effect on specificity and the resulting over-general memories. The study hypothesises that changing the cue words could impact on the findings related to autobiographical memory specificity, over-general memories, mood congruence and executive function.

Autobiographical memory refers to the recollection of all the past events of a person's life that contribute to a person's sense of self (e.g., Conway, 2005; Williams et al., 2007). Reduced specificity of autobiographical memory (autobiographical memory specificity; AMS) in participants currently diagnosed with depression is a phenomena well documented in memory literature (Williams & Broadbent, 1986). Reduced specificity of autobiographical memory refers to difficulties producing memories that include exact episodic experiences involving the *who*, *what*, *where*, and *when* of a remembered event. The literature reports that participants with a diagnosis of depression produce overgeneral accounts of their experiences (Williams et al., 2007). A standard way of investigating autobiographical memory empirically is to administer the autobiographical memory test (AMT) to participants (see van Vreeswijk & de Wilde, 2004 for a review of the use of the AMT). Participants are provided with a range of cue words and asked to produce specific events related to each of the words. The events must have lasted for a day or less and can either be a significant or common event to the participant. For example, a specific memory related to the cue word *party* would be "I really enjoyed my birthday party last month and was thrilled with my present" whereas a general memory to this cue word would be "I enjoy going to parties".

However, Howe, Cicchetti, and Toth (2006) have highlighted that the findings in the literature related to reduced AMS in depression are far from clear. They discuss the plausibility of

the memory effects seen in individuals representing motivational issues related to task completion or willingness to report memories rather than global memory deficits as a result of depression (also see Burt, Zembar, & Niederehe, 1995). Howe et al. (2006) raise specific points that are inconsistent with the idea of a global deficit of autobiographical memory specificity and depression. First, they point out that across studies, specific memories are reported over 50%, and often over 75% of the time in individuals with depression, or those who have been traumatised (Dalgleish et al., 2003). They also highlight the finding that individuals with a diagnosis of depression tend to recall specific memories when they are cued with negative words illustrating that mood congruence may have an influence. Overall, there is considerable evidence that depressed mood does not *inevitably* lead to the inaccessibility of specific, autobiographical memories. Indeed, individuals with depression may have all too specific recollections, ones they perhaps unsuccessfully try to avoid. Finally, executive functioning (see below) has been implicated in the presence of autobiographical memory generality in depression (Williams, 2006), which is an important factor to take into account. Given the contradictory nature of the empirical findings on depression and autobiographical memory, a different approach to the research is required, one that links motivational factors with changes in executive functioning and which expands the scope of the current autobiographical memory test.

Executive functioning has been implicated as an important factor in the reduced specificity/depression literature (Williams, 2006; Dalgleish et al 2007) and there is a growing body of evidence illustrating impaired executive functioning in depression more generally (see Burt, Zembar, & Niederehe, 1995). Executive functioning refers to the various higher order cognitive processes and structures that integrate and control other cognitive activities such as sequencing, planning and initiation. Dalgleish et al. conclude that lower levels of executive functioning may be a risk factor for developing depression in the first place (see Klein and Boals, 2001). They also propose that individual with a diagnosis of depression may be effortfully engaged in a process of attempting to inhibit distressing cognitions; thus their levels of executive functioning are compromised from the offset. This would then lead to much lower levels of perceived functioning in tasks requiring higher order

cognitive functioning. Their work was largely based on a sub-clinical sample therefore more research that investigates the relationship between reduced specificity, depression and executive functioning in clinical samples is necessary.

The CaRAFAX model (Williams, 2006) has been proposed to explain the presence of autobiographical memory specificity. This is built on Conway and Pledyll-Pearce's (2000) self-memory system and Williams, Styles, and Shapiro's (1999) affect regulation hypothesis. The CaRAFAX model suggests that three processes; capture and rumination, functional avoidance and executive dysfunction are important factors that lead to the production of over-general memories. In capture and rumination, negative self-schemas are activated leading to a truncation of the memographical search process leading to reduced specificity. In functional avoidance, individuals avoid specific recollection in order that negative affect is not triggered as a protective mechanism. In the model, executive dysfunction affects specificity by influencing behaviour and cognition individually or in combination. This again halts the memographical search process leading to the production of over-general memories.

A systematic review of empirical studies investigating the role of executive functioning in the reduced specificity/depression relationship was conducted by Malone, Reilly, and Howe (In Preparation). Of the nine studies investigated, five implicated executive functioning in the autobiographical memory specificity/depression relationship, two concluded that executive functioning had an indirect influence and two found a partial relationship. Barnhofer, Crane, Spinhoven and Williams (2007) conclude that under conditions of high cognitive load participants recall fewer specific memories. They also found that for participants who had previously been depressed dysfunctional attitudes predicted specificity when cognitive control was undermined. Raes et al. also discovered a relationship between poor executive functioning and reduced specificity of autobiographical memory in a clinical sample. Yamamoto and Shimada (2012) concluded that participants previously diagnosed with a depression may be impaired on a range of cognitive

capabilities including executive functioning. One of the two studies reporting an indirect relationship found a positive correlation between specific memories and working memory generally but not executive functioning. Holland, Ridout, Walford and Geraghty (2012) found that younger adults produced more specific memories than older adults and that this was related to executive functioning tested via a number generation task. Overall the findings implicate executive functioning in the reduced specificity/depression relationship warranting further empirical investigation. These accounts are also consistent with models of autobiographical memory specificity such as Conway Pleydell-Pearce (2000) and Williams et al. (2006, 2007).

There are however many inconsistencies. Often research articles utilising the AMT do not state which cue words were used to elicit memories. It is important to investigate the relevance of the cue words used as well as the memories that they produce. That is, for participants with a depressive disorder, the stimuli used to investigate the properties of the recollections needs to be meaningful and relevant in order to sustain interests and provide meaning to the participants in describing the memories. For example, Spinhoven, Blockting, Kremers, Schene, and Williams (2007) investigated the parameters of the AMS effect and discovered that participants with depression (as well as participants with borderline personality disorder) were more likely to respond to cue words with less specificity if those cue words were related to dysfunctional schemas and attitudes highly endorsed by the participant. Barnhofer et al. (2007) also demonstrated that content is of particular importance in AMS effects, particularly when cognitive functioning is compromised.

A final methodological issue when interpreting the findings from studies investigating overgeneralisation concerns the actual implementation of the AMT. This may influence the pattern of results when investigating autobiographical memory specificity. For example, studies can vary the mode of presentation of the test, sometimes using visual presentation, auditory presentation, or both. It may be that these modes of presentation have different effects on important factors such as motivation or comprehension. Deeber Hermans and Raes (2009) discovered that using an AMT

with minimal instructions produced far fewer specific memories. Thus it is clear that the operationalisation of the AMT is of importance in producing specific memories.

Although a number of studies have reported overgeneral autobiographical memories in participants with depression (Williams et al., 2007), it is not clear that basic memory processes are at the root of this phenomenon. Despite the evidence from Williams et al. suggesting that memory processes may be involved, the relationship between affective disorders and the recollective process is considerably more complex. Reduced specificity may be an artefact of reduced motivation to elaborate on memories in an experimental setting, inappropriate use of questioning, or a consequence of reduced executive functioning. Additionally, it is plausible that reduced specificity is a protective cognitive defence mechanism that may be minimising the effects of emotions that may accompany distressing or upsetting memories. This does not mean that specific memories are not available however, but that they may not necessarily be volunteered by participants as a protective measure. The distinction between memory biases and reporting difficulties has important clinical and research implications, i.e. data collected may be an artefact of reporting rather than a memory bias.

Thus in the current research, the authors argue that the experiencing of depressive symptoms does not necessarily lead to reduced specificity of autobiographical memories. There are a range of factors that can lead to participants producing more over-general memories within the experimental situation such as reduced motivation, recall difficulties, poor questioning from the researcher, reporting criterion and executive functioning. In addition these differences are most prominent with mood-congruent depression relevant material.

The current study investigated AMS with a modified AMT (see procedure) that takes into account the factors discussed in order to elicit greater levels of specificity in participants diagnosed with depression. Levels of executive functioning were also measured using the trail making task of the D-KEFS to investigate its role. In order to do this, the following hypotheses are tested:

1. Participants diagnosed with depression will produce fewer specific memories than non-depressed matched controls on the AMT (replication).
2. Participants will produce more specific memories when tested with a modified AMT in comparison to the AMT.
3. Valence of word type will produce a mood congruency effect for participants with a diagnosis of depression.
4. Executive functioning will be positively correlated with increased levels of autobiographical memory specificity.

Method

Design

The experiment utilised a 2 x 2 x 2 mixed design with six factors; Group (diagnosed with depression, matched non-depressed controls), Test (AMT, modified AMT) and Word Type (Positive. Negative). The group factor was between participant and Test and Word Type were within participant. There was one dependent variable; Memory Type – either specific or general.

Participants

There were sixty participants in total. The experimental group consisted of 30 participants diagnosed with major depressive disorder by a qualified clinical psychologist or other healthcare practitioner, and a matched control group of 30 participants with no significant depressive symptoms; 60 participants in total. Of the total number of participants, 20 were male and 40 female, with an equal gender split in both conditions. The experimental group were recruited from Liverpool University student health services, which has approximately 27, 000 registered patients. Control participants were recruited from the wider student population and were matched on gender, age and educational status. The inclusion criterion for participants diagnosed with depression required that participants were in the bracket for moderate depression (score of 10, or above) on the PHQ-9 (patient health questionnaire, Kroenke, Spitzer, & Williams, 2001). Levels of anxiety were also measured with the GAD-7 (Spitzer, Kroenke, Williams, & Lowe, 2006). The PHQ-9 and the GAD-7 are routinely used by NHS practitioners to ascertain levels of depressive and anxious feelings. Exclusion criterion included history of other psychiatric disorders such as schizophrenia, bi-polar disorder and personality disorders and a diagnosis of either dyslexia or dyspraxia. This was self-rated by participants. Participants were not required to have English as a first Language, but were sufficient in the English up to degree level. Participant demographics can be seen in table 1.

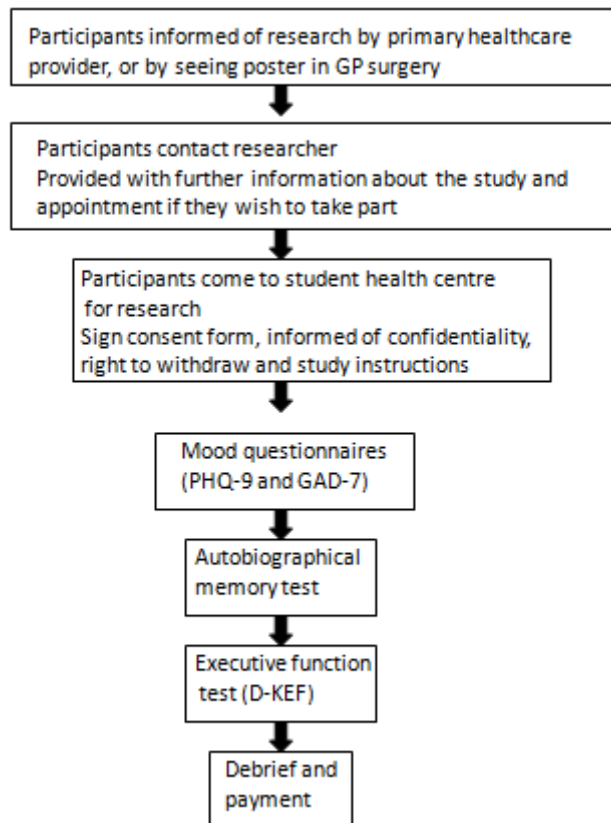
Table 1: Participant demographics

Demographic	Group	Mean	Standard deviation	Range
Age	Depressed	23.7	4.3	18-36
	Control	22.4	4.7	18-33
Executive function	Depressed	60.1	17.38	36-81
	Control	68.5	13.2	30-105
PHQ-9	Depressed	16.1	4.3	10-23
	Control	4.2	2.4	0-8
GAD-9	Depressed	12.4	4.1	5-19
	Control	3.7	2.7	0-12

Procedure

Participants were recruited via the student health centre, where they were provided with an information sheet (see Appendix A) and asked to sign a consent form (Appendix B), agreeing to participation in the study and to be contacted to arrange a study appointment. Participants had 24 hours after reading the information sheet to consent before taking part. Participants were paid a £5 voucher as a thank you for taking part in the research. During testing, participants were presented with words from a traditional AMT and modified version eliciting greater specificity. See Table 2 for all words used. In addition participants took the trail making test of the D-KEFS (Delis, Kaplan & Kramer; 2001) to measure executive functioning, the PHQ-9, and the GAD-7. The experiment took approximately 30 minutes. Participants diagnosed with depression were invited to take part in the study following assessment at the Student Health Centre by a clinical psychologist, or via their general practitioner or other healthcare professional. See figure 1 for participant flow chart.

Figure 1: Participant flow-chart describing process through research



Materials and measures

Autobiographical memory test (AMT). The AMT was conducted exactly as described by Williams and Broadbent (1986). Ten cue words were used, five pleasant, and five unpleasant. This tool has been used to assess autobiographical memory in numerous studies since its development in the 1980's.

Modified AMT. The modified AMT was based on that used by Hauer, Wessel, Geraerts, Merckelbach, and Dalgleish (2008), and also consisted of ten words, five pleasant/positive and five unpleasant/negative. Words for the AMT were selected based on high rated levels of imaginability, concreteness and how readily participants felt they would elicit specific memories. The 10 words were identified by asking a pool of 38 participants (students of the University of Liverpool) to rate 60 words on a scale from 1-9 on the three dimensions: imaginability, concreteness and specificity. The

following scale dimensions were provided to the participants to make the ratings: 1) imaginability - 1 = Not at all visually imaginable, 9 = extremely imaginable, 2) concreteness - 1 = extremely abstract, 9 = extremely concrete and 3) specificity - 1 = does not easily elicit a specific memory, 9 = extremely easily elicits a specific memory. Means were calculated for all the words and the highest rated words for all dimensions were identified. Following this the 10 that were most closely matched with words from the original AMT for frequency, valence, emotional arousal and length were identified and used in the modified autobiographical memory test. The Affective Normalised English Words (ANEW; Bradley & Lang, 1999) was used to norm the words. See table 2 for values for valence, arousal frequency and mean scores for imaginability, concreteness and specificity for both word lists AMT and modified AMT.

Table 2. Norms for all words used on autobiographical memory test

	Valence	Arousal	Frequency	Imaginability (M)	Concreteness (M)	Specificity (M)
AMT words						
Positive/pleasant						
Happy	8.21	6.49	98	7.8	6.9	7.5
Safe	7.07	3.86	58	6	6.5	6.6
Interested	6.97	5.66	330	5.5	5.8	6.5
Successful	8.29	6.11	93	6	5.5	6.7
Surprised	7.47	7.47	58	7	6.3	7
Negative/unpleasant						
Sorry	-	-	-	5	5.4	6.5
Angry	2.85	7.17	45	7.5	6.5	7.2
Clumsy	4	5.18	6	6.1	5.8	6.4
Hurt	1.9	5.85	37	5.6	5.1	6.8
Lonely	2.17	4.51	25	6.7	5.7	6.2
Modified AMT						
Positive/pleasant						
Bright	7.5	5.4	8.7	7.7	7.1	7.1
Cuddle	7.72	4.4	-	8.2	8.3	8.3
Party	7.86	6.69	216	8.3	8.1	8.1
Sun	7.55	5.04	112	8.8	8.5	7.1
Beautiful	7.6	6.17	127	7.9	6.6	7.6
Negative						
Thief	2.13	6.89	8	7.4	7.5	5.7
Funeral	1.39	4.94	33	8.2	7.7	8.5
Nervous	3.29	6.59	24	8.4	5.8	7.4
Sad	1.61	4.13	35	6.7	6.2	7.5
Danger	2.95	7.32	70	6.2	6.0	6.4

In total participants were presented with twenty words in one of two presentation orders to account for order effects. Participants were asked to produce a specific memory from the events of their life based on each of the cue words. They were told that the memory should relate to a specific time and place when something happened to them, and that it could be something that happened recently or a long time ago. Participants were given an example of a specific memory and a more general memory; “for example a specific memory based on the cue word ‘party’ might be something like; I went to my best friends 21st Birthday party at an Italian restaurant in town 3 months ago and had a great time, a general memory based on the cue word ‘party’ might be something like; I enjoy going to parties”. Participants were not given a time limit for this and were told they could leave blank any sections for which they could not think of a memory. The instructions were identical for the traditional AMT and the modified AMT and participants were presented both words lists within the same test. Memories were coded as specific memories if they were defined as lasting one day or less and happened in a particular instance. General memories were classed as such if they lasted for longer periods of time or if they occurred repeatedly over time. An interrater reliability analysis was performed using the Kappa statistic on a 10% sample of 1200 responses obtained in order to determine the reliability of the coding system. The interrater reliability between two raters was found to be $Kappa = .708$ ($p < .001$), 95% CI (.39, 1). This represents substantial agreement according to Landis & Koch (1977).

Executive functioning. The trail making test from the D-KEFS (Delis, Kaplan & Kramer; 2001) was selected as the executive functioning test used. The D-KEFS is regarded as a valid index of executive functioning (Arbuthnot & Frank; 2001). The D-KEFS requires participants to connect circles with numbers from 1-25 as quickly as possible and to alternate between numbers and letters. Only part 4; number letter switching was used in the study. The measure used is time in seconds taken to complete the task. If participants make an error this is pointed out and they continue from when they were last correct. Shorter times on this test represent higher levels of executive functioning.

GAD-7. This is widely used in clinical practice within the NHS to assess anxiety and forms part of the IAPT (improving access to psychological therapies) minimum data set (DoH, 2008a). The *GAD-7* is scored in the following way; not anxious: 0-4, mild anxiety: 5-9, moderate anxiety: 10-14, severe anxiety: 15-21. A score of 8 is the optimum sensitivity and specificity cut off to indicate caseness for anxiety (Kroenke, Spitzer, Williams, Monahan and Lowe 2007). The *GAD-7* has been validated in the US however there are no UK validation data (Richards & Suckling 2009).

PHQ-9. This is routinely used within the NHS to assess severity of depression according to DSM-IV criterion and has been shown to have good reliability and validity (Kroenke, Spitzer & Williams, 2001) also forms part of the minimum data set recommended by IAPT. The *PHQ-9* is very brief to administer, around 1-2 minutes. Scores on the *PHQ-9* are classified in as; not depressed: 0-4, mild: 5-9, moderate: 10-14, moderate/severe: 15-19, severe: 20-27. A score of 10 is the threshold for caseness where the sensitivity and specificity of the measure are optimal (Richards & Suckling 2009).

Ethics

Ethical permission was sought from IRAS (integrated research application system), the NHS ethical approval system. All participant data was anonymised, and stimulus material was carefully constructed to avoid distress. Participants were all provided with information about the study (see Appendix A) and given 24 hours to decide if they wished to take part. All participants gave informed consent (see Appendix B) and were provided with information about support services in the debrief, in the unlikely event that they were to become distressed by the cue words used in the study. In addition, the research took place in a clinic where a number of healthcare professionals could be called on. In addition all data was collected by a Trainee Clinical Psychologist in the final year of study with clinical and research experience.

Results

The data were subjected to 2 x 2 x 2 MANOVA's (Group: diagnosed with depression, matched non-depressed controls, Test: AMT, modified AMT, Word Valence: Positive, Negative). See tables 3 and 4. To investigate interactions, the data were also subjected to a 2 x 2 x 2 mixed ANOVA with the same factors. Correlational analysis was performed to explore the role of executive functioning.

Overall

Overall, there was a main effect of condition on number of autobiographical memories recalled ($F(4,55) = 2.781, p = .035, \eta_p^2 = .168, \beta = .726$). Post-hoc tests ($p < .05$) showed that control participants recalled significantly more autobiographical memories ($M = 18.03, SD = 2.5$) than participants with a diagnosis of depression ($M = 17.5, SD = 2.7$). In addition, significantly more specific memories were recalled on the modified AMT ($M = 6.5, SD = 2.4$) compared to the traditional AMT ($M = 5.6, SD = 2.1$) ($t = 20.298, df = 59, p = .001$).

Specific autobiographical memories

There was a main effect of condition for specific autobiographical memories on the traditional AMT ($F(1,58) = 10.73, p = .002, \eta_p^2 = .156, \beta = .896$), where participants with a diagnosis of depression recalled significantly fewer specific memories ($M = 4.8$) than matched controls ($M = 6.5$). There was also a main effect of condition for the modified AMT ($F(1,58) = 5.65, p = .021, \eta_p^2 = .189, \beta = .648$) where participants with a diagnosis of depression recalled significantly fewer specific memories ($M = 5.8$) than matched controls ($M = 7.2$).

When executive functioning was run as a covariate¹ there was still an effect for the traditional AMT ($F(1,57) = 8.06, p = .006, \eta_p^2 = .124, \beta = .797$) on specific autobiographical memories, that is participants with a diagnosis of depression recalled fewer specific memories ($M = 4.8, SD = 1.8$) than matched controls ($M = 6.5, SD = 2.1$). However the effect for the modified AMT no longer remained that is there was no statistically significant difference between the two groups on number of specific memories recalled when level of executive functioning was accounted for.

General autobiographical memories

There was a main effect of condition for general autobiographical memories on the traditional AMT ($F(1,58) = 6.426, p = .014, \eta_p^2 = .10, \beta = .703$), where participants with a diagnosis of depression recalled significantly more general memories ($M = 3.7$) than matched controls ($M = 2.3$). However there was no effect of condition on number of general memories recalled on the modified AMT ($F(1,58) = 3.485, p = .067, \eta_p^2 = .057, \beta = .451$).

Running executive functioning as a covariate in the analysis had no effect on the outcome with general autobiographical memories on with the traditional or modified AMT.

Word type valence

When the traditional and autobiographical memory tests were collapsed, there was a main effect of condition ($F(4,55) = 3.696, p = .01, \eta_p^2 = .2.12, \beta = .854$). That is, in the traditional and modified AMT's, participants with a diagnosis of depression recalled fewer positive and negative specific memories and more positive and negative general memories than matched controls (see table 3). When executive functioning was run as a covariate however, the only main effect identified

¹ Miller and Chapman, (2001) have questioned the validity of using covariates related to the group factor when allocation to groups is not random, as is the case in the current study. The issue is relevant as it is possible that participants with a diagnosis of depression may have poorer executive functioning than control participants; membership to the group with depression may not be independent of executive functioning. However in the current study we were less interested in what the residual variable represented and more interested in whether significant effects were still seen following covariation. Under these conditions Miller and Chapman (2001) suggest that running covariates is justified.

was for positive specific memories ($F(1, 57) = 9.112, p = .004, \eta_p^2 = .138, \beta = .843$) where participants with a diagnosis of depression recalled fewer positive specific memories ($M = 4.8, SD = 2.5$) than matched controls ($M = 6.9, SD = 1.9$).

Table 3: Mean and standard deviation for positive and negative memories overall

	Group	Mean (standard deviation)
Overall negative general	Control	2.23 (1.8)
	Depressed	3.4 (2.6)
Overall positive general	Control	2.1 (1.4)
	Depressed	3.5 (3.2)
Overall negative specific	Control	6.8 (1.8)
	Depressed	5.6 (2.3)
Overall positive specific	Control	6.9 (1.9)
	Depressed	4.8 (2.5)

There was a main effect of condition when the traditional and modified AMT's were separated ($F(1,58) = 2.390, p = .029, \eta_p^2 = .273, \beta = .843$). On the traditional AMT ($F(1,58) = 14.13, p = .001, \eta_p^2 = .196, \beta = .959$) participants with a diagnosis of depression recalled fewer ($M = 2.2$) positive specific memories than matched controls ($M = 3.3$). In addition, participants with a diagnosis of depression recalled significantly more positive general memories ($M = 1.9$) than matched controls ($M = 1.0$) $F(1,58) = 7.74, p = .007, \eta_p^2 = .118, \beta = .781$). Finally, there was a main effect for positive specific memories on the modified AMT ($F(1,58) = 5.871, p = .019, \eta_p^2 = .192, \beta = .664$). That is, participants with a diagnosis of depression recalled fewer positive specific memories ($M = 2.6$) than matched controls ($M = 3.5$).

This was further investigated with a 2 x 2 x 2 mixed ANOVA for specific and general memories separately to look at interaction. For specific memories there was a main effect of valence ($F(1,58) = 101.143, p = .001, \eta_p^2 = .636, \beta = .98$). Post-hoc tests ($p < .05$) showed that overall, participants recalled more positive specific memories ($M = 8.8$) than negative ($M = 6.07$). In addition there was a valence x test type interaction ($F(1,58) = 4.817, p = .038, \eta_p^2 = .072, \beta = .55$). Post-hoc tests ($p < .05$) showed that there was no significant difference in specific negative memories recalled between the traditional AMT ($M = 8.7$) and the modified AMT ($M = 9.1$), however significantly more specific positive memories were recalled on the modified AMT ($M = 6.5$) than the traditional AMT ($M = 5.6$). In addition there was a valence x condition interaction ($F(1,58) = 5.451, p = .02, \eta_p^2 = .083, \beta = .632$). Post-hoc tests ($p < .05$) showed that there were no significant differences between number of specific negative memories recalled between participants with a diagnosis of depression ($M = 8.7$) and matched controls ($M = 9.01$), however for specific positive words participants with a diagnosis of depression recalled significantly fewer memories ($M = 6.6$) than matched controls ($M = 7.8$).

For general memories, there was a main effect of valence ($F(1,58) = 559.127, p = .001, \eta_p^2 = .906, \beta = .99$). Post-hoc tests ($p < .05$) showed that overall, participants recalled fewer positive specific memories ($M = 2.8$) than negative ($M = 8.8$). In addition there was a valence x condition interaction ($F(1,58) = 9.547, p = .003, \eta_p^2 = .141, \beta = .86$). Post-hoc tests ($p < .05$) showed that there was no difference between number of negative general memories recalled between participants with a diagnosis of depression ($M = 8.7$) and matched controls ($M = 9.01$), however participants with a diagnosis of depression recalled significantly more general positive memories ($M = 3.4$) than matched controls ($M = 2.1$).

Table 4: Mean/standard deviation of all word/list types for group diagnosed with depression and matched control

Memory type	Mean (Standard deviation) both groups	Mean (Standard deviation) Depressed	Mean (Standard deviation) Control	Significant difference P < .005
AMT specific overall (max 10)	5.7 (2.2)	4.8 (1.9)	6.5 (2.1)	*
AMT specific positive (max 5)	2.7 (1.3)	2.2 (1.1)	3.3 (1.2)	*
AMT specific negative (max 5)	2.8 (1.08)	2.6 (.96)	3.1 (1.1)	
Modified AMT specific overall (max 10)	6.5 (2.4)	5.8 (2.9)	7.2 (1.6)	*
Modified AMT specific positive (max 5)	3.1 (1.4)	2.6 (1.7)	3.5 (1.7)	*
Modified AMT specific negative (max 5)	3.36 (1.3)	3.1 (1.6)	3.6 (.92)	
AMT general overall (max 10)	3.01 (2.3)	3.7 (2.6)	2.3 (1.7)	*
AMT general positive (max 5)	1.4 (1.3)	1.9 (1.6)	1.0 (.89)	*
AMT general negative (max 5)	1.55 (1.1)	1.8 (1.1)	1.3 (1.14)	
Modified AMT general overall (max 10)	2.6 (2.4)	2.0 (1.4)	3.2 (3.1)	*
Modified AMT general positive (max 5)	1.3 (1.3)	1.6 (1.6)	1.1 (.84)	
Modified AMT general negative (max 5)	1.2 (1.3)	1.5 (1.59)	.93 (.90)	

Executive functioning

To further examine the relationship between the various factors investigated and executive functioning, correlation analysis was performed (see table 5). There was a significant positive correlation between executive functioning and current mood assessed by the PHQ-9 ($r = .301$, $n = 60$, $p = .019$), anxiety assessed by the GAD-7 ($r = .283$, $n = 60$, $p = .028$), general memories produced in the AMT test ($r = .365$, $n = 60$, $p = .004$), and general memories produced in the modified AMT ($r =$

.290, $n = 60$, $p = .025$). There was a significant negative correlation between executive functioning and specific memories overall ($r = -.264$, $n = 60$, $p = .042$) and specific memories produced in the modified AMT ($r = -.255$, $n = 60$, $p = .049$).

Table 5: Correlation table (* correlation significant at the .05 level, ** correlation significant at the .01 level)

	Executive function	PHQ-9	GAD-7	Overall general	Overall specific	Overall negative	Overall positive	AMT general	AMT specific	Modified AMT general	Modified AMT specific	Overall No. memories
Executive function	1											
PHQ-9	.301*	1										
GAD-7	.283*	.893**	1									
Overall general	.222	.117	.246	1								
Overall specific	-.264*	-.354**	-.438**	-.583**	1							
Overall negative	.127	-.091	-.054	.285*	.167	1						
Overall positive	.140	-.224	-.143	.285*	.227	.654**	1					
AMT general	.365**	.242	.360**	.691**	-.719**	.447**	.346**	1				
AMT specific	-.249	-.359**	-.429**	-.440**	.896**	.166	.310*	-.726**	1			
Modified AMT general	.290*	.223	.320*	.676**	-.810**	.218	.274*	.745**	-.563**	1		
Modified AMT specific	-.255*	-.317*	-.396**	-.606**	.924**	.135	.135	-.596**	.666**	-.889	1	
Overall No. memories	.147	-.170	-.111	.272*	.220	.859**	.941**	.413**	.286*	.289	.138	1

Discussion

The study posed the following hypotheses:

1. Participants diagnosed with depression will produce fewer specific memories than non-depressed matched controls on the AMT (replication).
2. Participants will produce more specific memories when tested with a modified AMT in comparison to the AMT.
3. Valence of word type will produce a mood congruency effect for participants with a diagnosis of depression.
4. Executive functioning will be positively correlated with increased levels of autobiographical memory specificity.

Hypothesis 1 & 2: Overall, participants currently experiencing depressive symptoms recalled fewer autobiographical memories than matched controls regardless of test type and valence (replication). Participants with a diagnosis of depression also recalled fewer specific memories than matched controls on the traditional AMT (replication) and on the modified AMT. When executive functioning was run as a covariate however there was no difference between the two groups on the modified AMT but the effect on the traditional test remained. In addition, participants with a diagnosis of depression recalled more general autobiographical memories than matched controls, regardless of valence on the traditional autobiographical memory test (replication). However there was no difference in number of general memories recalled between groups on the modified autobiographical memory test. These findings remained regardless of whether executive functioning was run as a covariate or not. Finally, significantly more specific memories were recalled overall (for both controls and group with depression diagnosis) on the modified AMT compared to the traditional AMT.

Hypothesis 3: When valence of word type was separated, participants with a diagnosis of depression also recalled fewer positive and negative specific memories, and more positive and negative general memories than matched controls. However when executive functioning was covaried the only identified difference was with increased positive specific memories for matched controls compared to participants with a diagnosis of depression. For the traditional AMT, participants with a diagnosis of depression recalled fewer positive specific memories and more positive general memories than matched controls however there was no difference between specific and general negative memories between the groups. For the modified AMT, participants with a diagnosis of depression also recalled fewer positive specific memories than matched controls however there was no difference between negative specific memories or positive/negative general memories.

There were no differences between negative specific memories recalled in all participants (depressed and control) between the modified and traditional AMT's, however more positive specific memories were recalled on the modified AMT compared to the traditional AMT. In addition, for negative specific memories there were no differences between conditions (depressed v's control), however participants with a diagnosis of depression recalled fewer positive specific memories than matched controls. In addition, while there were no differences between negative general memories between conditions, participants with a diagnosis of depression recalled significantly more positive general memories than matched controls.

Hypothesis 4: Executive functioning was also positively correlated with current mood, anxiety, general memories produced in both AMT's and negatively correlated with specific memories overall and specific memories on the modified AMT. The correlation between executive functioning and general memories was across both groups of participants; those with a diagnosis of depression and matched controls. The range of executive functioning skills was broad for both groups of participants, indicating that reduced executive functioning can lead to reduced specificity in its own

right regardless of depressive status. This is an important finding which may also have bearing on vulnerability to first and future episodes of depression.

Overall, the findings suggest that although there were differences overall between participants with a diagnosis of depression and matched controls, it appears that this difference can be lessened with the use of an AMT that elicits more specificity. Prior studies have reported over general autobiographical memories in participants with depression (Williams et al., 2007), however the conclusions from these and the current study indicate that it is not necessarily basic memory processes at the root of this phenomenon. When executive function was taken into account in the current study this also lessened the differences between participants with a diagnosis of depression and matched controls. According to the CaRAFAX model (Williams, 2006) participants produce fewer specific memories due to difficulties in higher level cognitive processes leading to a truncation of the memory system search. The model proposes that this occurs via either one or a combination of three processes; rumination, functional avoidance and executive dysfunction. The current study has demonstrated that via the use of material designed to elicit greater specificity, the negative impact of these processes can be lessened. In addition, and importantly, the relationship between reduced executive function and specificity was present regardless of depression status, providing further evidence that some differences reported in the literature does not necessarily represent global deficits of participants with a diagnosis of depression.

It is also plausible that reduced specificity is a protective cognitive defence mechanism that may be minimising the effects of emotions that may accompany distressing or upsetting memories as the CaRAFAX model proposes. This does not mean that specific memories are not available however, but participants may not necessarily volunteer the memories as a protective measure. This process may be unconscious and difficult to access, although implicit test of memory would aid investigation. The distinction between memory biases and reporting difficulties has important clinical and research implications.

Therefore despite some evidence that suggests that memory processes may be involved, the relationship between affective disorders and the recollective process is considerably more complex. The suggestion that reduced specificity may be related to reduced executive functioning is indicated in the current study and should certainly be a consideration for future work. It is an important finding that greater specificity can be elicited in participants with depression which has implications for theory and practice in terms of consideration of possible deficits of executive functioning for psychological assessment, formulation and maintenance of low mood. Clinicians can be aware of possible executive functioning deficits and take measures in therapy to reduce cognitive load in order that participants can better encode the learning and development done in the task of therapy. Psychoeducation about the possible effects of depression on memory processes and how to understand and overcome them will be important. Finally recent research using methods of training participants to remember and recall past positive events with greater specificity, vividness and concreteness are showing promising results (Dalgleish et al., 2013).

Limitations and future research

There are several limitations to the current study. Participants were excluded from the study if they had a diagnosis of psychiatric disorders other than depression such as schizophrenia, bi-polar disorder and personality disorders and a diagnosis of either dyslexia or dyspraxia, however this was self-rated rather than ascertained via assessment. The validity of self-rating has been questioned however (Nevin, 2009) therefore it would be beneficial to use a standardised assessment tool to identify mental health status such as the Standardised Clinical Interview for the DSM-IV (SCID).

The modified AMT was constructed by asking a separate group of participants to the experimental group to rate a range of work for how easily they elicit specific memories, the concreteness of the word and the imaginability of the word. The highest rated were then identified for the test. The participants that rated these words did not have a history of depression therefore it would be useful to replicate the pilot word rating with participants who have current low mood to

identify whether mood state alters ratings of words on the three dimensions participants were asked about (specificity, imaginability, concreteness).

The D-KEFS was the only tool used to assess executive functioning, therefore it would be useful to replicate the study using a wider range of tests designed to assess executive functioning. In addition, executive function was explored in terms of correlations from which we cannot infer causality. Studies which address this issue perhaps more longitudinally with cohort studies would be able to explore the role of executive functioning in the development of depression and how it may (if at all) act as a vulnerability factor.

Finally, one factor that was not taken into consideration in the current study was the presence and impact of trauma on the memory processes of participants. Research has demonstrated that once depression has been controlled for there is a significant relationship between trauma and autobiographical memory specificity (Hauer, Wessel, Geraerts & Dalgleish, 2008, Moore & Zoellner, 2007). There have been no studies to date that have investigated the role of executive functioning in this relationship as has been done with depression therefore it will be an important progression of the literature to investigate this.

Summary

The current study has replicated prior findings demonstrating reduced specificity of autobiographical memory in participants diagnosed with depression in the traditional autobiographical memory test lower recall of memories overall. However it also demonstrated that greater specificity could be elicited in all participants using a modified autobiographical memory test designed with words rated highly for imaginability and concreteness. In addition it demonstrated that when executive functioning was covaried the difference in specificity between participants with a diagnosis of depression and matched controls was not significant. Finally, executive function is positively correlated with autobiographical memory specificity. All of these findings have significant

clinical implications which can be implemented in the assessment, formulation and intervention phases of the task of psychological therapy.

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Chapter 3: Empirical study extensions

Extended discussion

The current thesis presented a systematic review in Chapter 1 exploring research investigations that have studied depression and the effects on reduced specificity of autobiographical memory and executive functioning. An empirical paper was introduced in Chapter 2 based on the conclusions drawn from the systematic review. The review concluded that executive functioning plays an important role in the often reported finding of reduced specificity of autobiographical memory in participants with a diagnosis of depression, but that the specific mechanism of action was unclear. Despite a prominence of findings suggesting a relationship between reduced specificity and executive functioning (Burt, Zembar & Niederehe, 1995), findings were also not consistent across all studies investigated in the review paper and it was still unclear how widespread this finding was due to the small number of studies that have addressed reduced specificity and executive functioning particularly. The wider body of literature relating to depression and autobiographical memory specificity is much vaster however the focus on executive functioning remains minimal, despite the prominence of the role of its role in theories of reduced specificity such as the CaRAFAX model (Williams, 2006). The systematic review concluded that the scope of research investigating the role of executive functioning in reduced specificity of autobiographical memory needed to be broadened to encompass participants with a current diagnosis of depression, using more tests of executive functioning and investigating factors that may elicit greater specificity in order to ascertain more clearly if differences found represented a global deficit or an artefact of the testing process.

The conclusions drawn from the systematic review formed the basis of the empirical paper presented in Chapter 2 which examined the role of executive functioning in reduced specificity of autobiographical memory in participants with a diagnosis of depression and matched controls. The study attempted to address the criticisms of studies reviewed in Chapter 1. In addition, a modified autobiographical memory test was created and piloted for the purpose of the study in order to try and elicit greater specificity in participants by using words highly rated for imaginability,

concreteness and specificity. This was based on the work by Hauer, Wessek, Geraerts, Merckelbach and Dalgleish (2008) who used a modified test to enable participants with a history of childhood abuse to produce memories with greater specificity. The full results and discussion are presented in Chapter 2, and concluded that while the study replicated prior findings that overall, and on the traditional autobiographical memory test, participants produced fewer memories and fewer specific memories it was possible to reduce this difference by using a modified test which elicited greater specificity. In addition there was a mood congruence effect for positive words and an overall relationship between executive functioning and autobiographical memory specificity. For the purpose of this extended discussion these three key findings are further developed.

Overall, participants recalled significantly more specific memories, regardless of valence with the modified autobiographical memory test. Words were matched on valence, arousal and frequency so we can be confident that none of these factors led to a bias towards the modified autobiographical memory test compared to the traditional test. This is a promising finding which provides evidence that under some conditions individuals can be encouraged to remember their life events with greater specificity. Choosing words that are more concrete and imaginable enables participants to produce this specificity. This also provides convergent evidence for the work of Hauer, Wessek, Geraerts, Merckelbach and Dalgleish (2008). If reduced specificity is related to the maintenance of low mood then using strategies with clients that encourage methods of remembrance that orientate to concrete and easily imaginable memories would be beneficial. In addition, studies that have investigated specificity of autobiographical memory and low mood have not always investigated the characteristics of the words they have used in their memory tests as was done in the empirical paper presented in Chapter 2. This was done in terms of valence, frequency, and arousal. It is important therefore for future studies to more thoroughly address the nature of the words that are used in order that the argument that reduced specificity is an artefact of the testing situation can be ruled out.

The mood congruent effect also provided some interesting findings. Mood disorders have long been associated with the processing of emotional stimuli Leppanen (2006). Watkins, Mathews, Williamson and Fuller (1992) describe mood congruent memory as memory for information that is consistent with current mood state. Participants with a diagnosis of depression produced fewer positive specific memories than matched controls on the traditional and modified autobiographical memory tests in the research presented in this thesis. However there was no difference between recall of negative memories on either tests. This is perhaps counter to expectations; often mood congruence leads to greater recall of material congruent to current mood, however in this study low mood led to a difficulty producing items incongruent to current mood. Material that is relevant to the self is processed more globally, and item specific processing is somewhat impaired. This may have been the mechanism which led to fewer specific memories for negative words for participants with a diagnosis of depression.

When the valence effects were unpicked and interactions explored, it demonstrated that the difference between the modified and traditional tests was also greater for positive memories. That is, the modified test elicited significantly more specificity for all participants with positive words compared to the traditional test however there was no difference for negative words. This may be related to the fact that the words for the test were rated by individuals who were not currently exhibiting depressive symptoms. The pilot of words conducted in the current study for the modified autobiographical memory test was conducted with participants not currently exhibiting depressive symptoms. If a pilot of words was done with participants experiencing depressive symptoms this may increase the chances of the words having salience for depression and thus increasing specificity. This is an important point for future work. Another interesting valence finding was the fact that participants with a diagnosis of depression produced more general positive memories than matched controls but there was no difference for negative memories. This may be related to executive functioning in that for positive words that are not congruent with current mood, participants find it difficult to inhibit the production of general memories leading to a truncation of the memory search.

Executive functioning has been implicated in reported differences in memory performance for participants with a diagnosis of depression and controls without current depressive symptoms (Marazziti, Consoli, Picchetti, Carlini, & Faraveli, 2010). While this was replicated to a certain degree in the current thesis, under conditions designed to elicit greater specificity the difference between individuals with a diagnosis of depression and matched controls could be reduced. In addition, poor executive functioning was associated with reduced specificity regardless of depression status. This indicates the complexity of the relationship and could be interpreted to demonstrate that some of the reported performance differences are a consequence of changes at an output level rather than memory processing differences. Additionally, it is possible that depression leads to impairments in the use of effortful memory strategies due to reduced sustained attention or the motivation to employ these strategies is reduced. Joormann (2010) has emphasised the role of cognitive inhibition in regulating emotion. Joormann claims that the inhibition of negative material is related to depression risk factors and that both emotional regulation and inhibition are central in the maintenance of depression. If executive functioning is impaired therefore this would act as a vulnerability factor for future episodes of depression, and also conversely as a way to mitigate against future episodes if executive functioning is accounted for in therapy.

It is important to distinguish between memory processes specifically and the effects of other processes, unrelated to memory. Researchers such as Burt et al. (1995) suggest there may be alterations to basic memory processes due to depression, however research investigating the effects of other factors such as reduced motivation or changes in executive functioning indicate that something else altogether may be causing changes in memory performance. It is important to therefore to distinguish between memographical effects and reporting effects. Castaneda et al. (2008) discovered that unipolar depression among young adults leads to only minimal cognitive deficits. They found this to be the case even when depressive symptoms were still presenting. However they report that a younger age of onset of illness was related to increased severity of illness and higher levels of cognitive dysfunction. This is an important finding in that it may be the

more complex cases of depression that involve other co-morbid disorders where differences in cognitive functioning and memory may be occurring. It is important to note that the clients included in the current research were within primary care and thus did not have the often complex presentations of depression seen more in secondary care. The finding of an association between poorer executive functioning and reduced specificity in the empirical paper of this thesis provided convergent evidence for this hypothesis. Thus it is apparent that the relationship between depression and cognitive deficits is a complex and multifaceted one that inevitably involves multiple factors and warrants further investigation.

Chapter 1 explored in depth the value of knowledge about the relationship between reduced specificity of autobiographical memory, executive function and depression for psychological assessment, formulation and intervention. It explored the stepped care model used within the National Health Service in the UK. The conclusions drawn were also applicable to the findings of the empirical paper. Executive functioning could be used as an extra assessment tool for depression, providing information about individuals' ability to encode information and of their general level of cognitive functioning. This could be regarded as an implicit way to measure broader difficulties related to depression. Information about executive functioning would also provide information about how to pitch the level of intervention and the need to reduce cognitive load pace appropriately etc. It will also be useful for clinicians to provide information about the potential effects of depression on cognitive functioning and the memory specificity and its relationship to future episodes. Severity of depression appears to be related to decreased executive functioning (Burt, Zembar & Niederehe, 1995) meaning that when working with clients with the most severe depression, clinicians need to be aware of the effects of reduced executive functioning. In addition to the need to be aware of the effects of reduced executive functioning and the tendency to produce over general memories, it is important that clinicians are alert to the idea that there are ways of reducing this tendency. The empirical paper presented in Chapter 2 demonstrated that under some conditions, participants with a diagnosis of depression can produce as many specific

memories as participants without a diagnosis of depression. The modified autobiographical memory test constructed for the purpose of the study elicited greater specificity in all participants thus there are ways of supporting individuals with a diagnosis of depression to produce more specific memories. This has implications on the materials that are provided to clients in therapy – material that is concrete and easily imaginable will produce more specific memories. The mood congruence effects seen in the empirical paper also have important implications. Participants with a diagnosis of depression were producing fewer positive memories than participants without a diagnosis. Hedlund and Rude (1995) discuss that negative schemas are functionally important in both the maintenance and development of depression thus interventions that enable clients to reflect on this and develop more realistic and positive schemas can support them to challenge their mood state and protect against future episodes of low mood. There is some recent emergent evidence detailing the efficacy of cognitive training as an intervention for depression. Dalgleish et al. (2013) detail the use of using positive autobiographical memories to protect against the effects of depressive ruminative thinking styles. They used an ancient mnemonic strategy called method-of-loci to train participants to imaging temporally locating positive autobiographical events around their environment. These positive memories were rehearsed and elaborated for they were vivid and contained concrete information and details. Recall of the positive memories reached ceiling and was sustained at a surprise follow up call a week later. Interestingly there were no differences between participants who were currently experiencing depressive symptoms and those in remission. Findings such as this demonstrate the efficacy for utilising autobiographical memory as an intervention for depression in addition to reducing cognitive load thus increasing cognitive functioning capabilities. It also provides a rationale for investigating the long term effects of such training on depressed mood and relapse rates.

As discussed in the empirical paper presented in Chapter 2 there are some limitations to the current work. The systematic review used a small sample of research papers due to the dearth of investigations studying executive functioning in autobiographical memory specificity and depression

thus no statistical analysis was performed on the effect sizes thus conclusions must be drawn with the small sample in mind. Despite the focus of all being on depression, not all the papers used participants with a current diagnosis of depression; subclinical participants and participants with a history of depression were used in two papers. Research has demonstrated that the same processing mechanisms may not be used for longstanding depressive illnesses compared to more transient mood states (Howe & Malone, 2011) thus consideration of study population is important. In addition, not all the papers in the review did find a direct association between executive functioning and reduced specificity in depression. It is important to take these limitations into consideration in regard to the current study hypotheses.

The empirical paper itself also had limitations. Although participants were referred to the study as they had been diagnosed with depression by a healthcare professional, there was no formal assessment of mental health status and history was self-reported by participants. It would be useful to conduct a more thorough assessment in order that all extraneous variables can be controlled for. In addition medication status was not confirmed for participants with a diagnosis of depression. Monleon, Vinader-Caerols, Arenas and Parra (2008) discuss the fact that antidepressant medication can have detrimental effects on cognitive functioning. They also point out that the newer types of antidepressant (SSRI, SNRI, MAOI) appear to have fewer cognitive effects compared to the older types of antidepressants (tricyclics). It will be important in future research investigating executive functioning to investigate and control for the effects of medication. The modified autobiographical memory test was not piloted on participants with a diagnosis of depression, thus future studies should also use a pilot group of participants with a diagnosis and control to account for any difference. Executive functioning was correlated in the empirical study however this relationship was not investigated further. This means that we cannot infer causality however the finding certainly warrants further research. Finally, trauma was not accounted for in the empirical study and has been implicated in the reduced specificity relationship (Moore & Zoellner, 2007). In addition, a robust finding linking childhood trauma and depression in later life has been reported (Boudewyn & Liem,

1995). This theme is developed further in the final section of Chapter 3 with a research proposal investigating executive functioning, autobiographical memory and trauma history.

Dissemination material

Research proposal

Autobiographical memory specificity and trauma: further investigating the role of executive functioning.

Aims: The current research aims to further investigate the parameters of autobiographical memory specificity. Research has shown that that using a modified version of the autobiographical memory test (AMT) can elicit greater specificity in participants with a diagnosis of depression (Malone, Reilly & Howe In Preparation) and in individuals with a trauma history (Hauer, Wessel, Geraerts & Dalgleish, 2008). Differences or changes in executive functioning in depression have been implicated in the depression/specificity relationship (Dalgleish et al, 2007). No research to date however has investigated the role of executive functioning and specificity of autobiographical memory in individuals with a history of trauma. The current research aims to investigate this relationship using the traditional autobiographical memory test, a modified test designed to elicit greater specificity and a range of executive functioning tests.

General background and relevant literature: Autobiographical memory is the recollection of all the past events of a person's life that contribute to their sense of self (see Conway, 2005; Williams et al., 2007). One memographical phenomena that has been much researched is reduced specificity of autobiographical memory (autobiographical memory specificity; AMS) in participants exhibiting depressive symptoms (see Williams and Braoadbent, 1986; Brittlebank, Scott, Williams & Ferrier, 1993; Dalgleish et al., 2007). Autobiographical memory specificity refers to retrieving memories of exact episodic experiences containing the *who*, *what*, *where*, and *when* of the remembered event. The autobiographical memory test (AMT) is often utilised to investigate autobiographical memory. In this test participants are provided with a range words and asked to produce specific events related to the words. The events must have lasted for a day or less and can either be a trivial or important event to the participant. A specific memory related to the cue word *happy* would be "I was really happy the day I got my exam results" whereas a general memory to this cue word would be "I feel

happy when the sun shines". There is a growing body of research investigating the impact of emotional disorders on autobiographical memory specificity however much of this research has focused on low mood and depression. As a result there are comparatively few studies investigating the effect of other emotional disorders on autobiographical memory specificity. The research that has been conducted however is beginning to build a picture of reduced specificity of autobiographical memory in individuals with a history of trauma (see Moore & Zoellner, 2007).

Traumatized individuals experiencing post-traumatic stress disorder (PTSD) often have detailed and specific intrusive memories of their trauma and although a common coping mechanism is to attempt to avoid consciously thinking about the trauma, this may actually increase the occurrence of intrusive thoughts. Paradoxically however the same individuals appear to produce over general memories when tested with the AMT. One hypothesis for why this might be the case is framed around the effort regulation hypothesis (Conway & Pleydell-Pearce, 2000). This proposes that reduced specificity is caused by a disruption of effortful and generative memory retrieval within a hierarchically organized memory structure. If this top-down memory search is halted prematurely then general autobiographical memories are retrieved from higher up the memory hierarchy. This can be summarized as an avoidant memory style which can have a protective function in trauma. However intrusive recollections of trauma memories follow a bottom-up memory search process triggered by environmental cues of trauma material. This process of direct access bypasses the stage of generative search leading to very specific and vivid memories.

Executive functioning has been implicated in the production of over general autobiographical memories in depression (see Williams 2006) however this relationship has not yet been investigated in trauma. The current study aims to rectify this therefore building on a developing body of evidence demonstrating the impact of trauma on over general autobiographical memories focusing specifically on executive functioning.

Hypotheses:

1. Participants with a diagnosis of PTSD will produce fewer specific memories than non-depressed matched controls on the AMT
2. PTSD symptomology will be positively correlated with mood and negatively correlated with executive functioning and autobiographical memory specificity.
3. Executive functioning will be positively correlated with increased levels of autobiographical memory specificity.

Design: A 2 x 2 between participant design will be utilised with four conditions; Group (diagnosed with PTSD, matched controls without PTSD symptomology), Test (traditional AMT, modified AMT), and two dependent variables; Memory Type (specific, general).

Participants: The experimental group will consist of participants currently experiencing symptoms consistent with PTSD and a matched control group of participants with no significant PTSD symptoms. The experimental group will be recruited from Liverpool University student health services, which has approximately 27,000 registered patients. Control participants will be recruited from the wider student population and will be matched on gender, age and educational status. The inclusion criterion for participants will be a diagnosis consistent with PTSD diagnosed by a clinical psychologist or other healthcare professional and a score of 33 or above on the Impact of Event Scale-Revised (Horowitz, Wilner & Alvarez, 1979). The PHQ-9 (patient health questionnaire, Kroenke, Spitzer, & Williams, 2001) will be used to measure depressive symptoms and levels of anxiety will also be measured with the GAD-7 (Spitzer, Kroenke, Williams, & Lowe, 2006) and run as a covariate in the analyses. Exclusion criteria include history of other psychiatric disorders such as schizophrenia, bi-polar disorder and personality disorders. This will be self-rated by participants. Information will also be collected on medication status. G*3 power analysis suggests a sample size of up to 60 participants. Thus the current study aims to collect data from up to 30 participants

diagnosed with PTSD and 60 matched controls. Given the pool of potential participants available via the student health centre (over 100/year) this is a viable sample number. In addition, this number is consistent with comparable literature (See Sumner, Griffith & Mineka, 2011).

Ethics: Ethical permission will be sought from IRAS. All participant data will be anonymised, and stimulus material will be carefully constructed to avoid distress. Participants will give informed consent form and be provided with information about support services in the debrief, in the unlikely event that they become distressed by the cue words used in the study.

Materials and procedure: Participants will be presented with either a version of the traditional AMT or a modified version eliciting greater specificity (Malone, Reilly, Howe, In Preparation). In addition participants will take the trail making test of the D-KEFS to measure executive functioning, the PHQ-9, and the GAD-7. The experiment will take approximately 30 minutes. Participants diagnosed with depression will be tested prior to commencing therapy and will be invited to take part in the study following assessment at the Student Health Centre by a clinical psychologist.

AMT – The AMT will be exactly as described by Williams and Broadbent (1986). Ten cue words will be used, five pleasant, and five unpleasant.

Modified AMT – The modified AMT will be the one used by Malone, Reilly and Howe (In Preparation). Words for the AMT were selected based on high rated levels of imaginability, concreteness and how readily participants felt they would elicit specific memories.

Executive functioning - The trail making test from the D-KEFS (Delis, Kaplan & Kramer; 2001) is regarded as a valid index of executive functioning (Arbuthnot & Frank; 2001). The D-KEFS requires participants to connect circles with numbers from 1-25 as quickly as possible and to alternate between numbers and letters.

Impact of Event Scale-Revisited This is tool for measuring stress reactions after traumatic events and has been widely used for over 20 years (Horowitz, Wilner & Alvarez, 1979). It has good content validity, construct validity and external validity (see Sundin & Horowitz, 2002).

GAD-7 This is widely used in clinical practice to assess anxiety and forms part of the IAPT minimum data set (DoH, 2008a).

PHQ-9 - This is routinely used within the NHS to assess severity of depression according to DSM-IV criterion (see Kroenke, Spitzer & Williams; 2001).

Analysis: Between participant MANOVA's will be used to perform the primary analysis of the data, with two dependent variable; specific and general memories. Correlation analysis will be used to test hypotheses 4. Executive functioning (hypothesis 4) will also be run as a covariate in the main analysis.

Clinical relevance: Studies such as the one outlined above provides information about the structures and processes occurring in the memory system in individuals with a history of trauma. Investigating the mechanisms such as executive functioning that may account for reduced specificity of autobiographical memory enables interventions to be developed that can help mediate against disruptions to memory processes. In addition it provides valuable information that clinicians can use in their assessment and formulation of individuals with a history of trauma.

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Appendices



Participant information sheet

Title of the research: Autobiographical memory and depression

Please contact c.malone@liverpool.ac.uk if you wish to take part

Version: 1.1

We would like to invite you to take part in our research study. Before you decide we would like you to read this information sheet so you understand why the research is being done and what it would involve for you. It is important for you to understand why the research is being done and what it will involve. Please feel free to ask us if you would like more information or if there is anything that you do not understand. Please also feel free to discuss this with your friends, relatives and GP if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to. The information sheet should take about 15 minutes to read through.

Part 1 of this information sheet tells you the purpose of the study and what will happen to you if you take part. **Part 2** gives you more detailed information about the conduct of the study. If anything is not clear we can give you more information.

Part 1

What is the purpose of the study?

The study aims to look at autobiographical memory (the memory of events of peoples' lives) in people diagnosed with depression. The research you have been invited to take part in will compare the types of autobiographical memories people experiencing low mood recall compared to people not experiencing low mood.

Why have I been invited?

You have been asked to take part in this study as one of the healthcare professionals responsible for your care has suggested you might be interested. You may be experiencing feelings of low mood or depression.

Do I have to take part?

It is up to you to decide to join the study. If you do agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive. If you do decide to take part all the information will be kept confidential and your name will not appear in any part of the final research report.

What will happen to me if I do take part, and what will I have to do?

You will meet with a researcher at one of the three Brownlow Group Practice sites to take part in the study on one occasion. It should take about 30 minutes to complete all aspect of the study.

You will be asked to fill out two mood questionnaires one looking for depression and one looking for anxiety. You will also be given some everyday words, and asked to write down a memory from your

life that each of the words remind you of. Some of these words might be emotion words. Finally you will be asked to do a paper and pencil task where you will be asked to join up numbers and letters at speed.

Expenses and payment

As a thank you for taking part in the research study you will be given a £5 voucher.

What are the possible disadvantages of taking part?

Some of the words used in the study are emotional in content and you may find these distressing. The words are all words that you come across in your everyday life. We will ask you to recall memories for the events of your life, which you may also find distressing.

What are the possible advantages of taking part?

We cannot promise the study will help you specifically, but the information we get from this study may help improve the treatment of people diagnosed with depression.

What happens when the research study stops?

You will meet with a researcher once to take part in the study. This will not interfere in any treatment you may be receiving, so any treatment will continue as normal, before, during and after the research study.

What happens if there is a problem?

Any complaint about the way you have been dealt with during the study or any possible harm you might suffer will be addressed. The detailed information on this is given in Part 2.

Will my taking part in the research study be kept confidential?

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. The details are included in Part 2.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision.

Part 2

What if relevant new information becomes available?

If this happens, the researcher or your doctor might consider you should withdraw from the study. He/she will explain the reasons and arrange for your care to continue.

What will happen if I don't want to carry on with the study?

You are completely within your rights to withdraw from the study at any time. If you wish to withdraw from the study your data will be destroyed. You can keep your participant payment, and this will not affect the care you receive. However if you decide to withdraw after the research study has been completed and written up it would be impossible to remove your data. Please contact Catherine Malone at c.malone@liverpool.ac.uk no later than one week after you have completed the research if you would like your data to be removed.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions: c.malone@liverpool.ac.uk. If you remain unhappy and wish to complain formally, you should contact the Research Governance Officer on 0151 794 8290 (ethics@liv.ac.uk). When contacting the Research Governance Officer, please provide details of the

name or description of the study (so that it can be identified), the researchers involved, and the details of the complaint you wish to make. Participants taking part in a University of Liverpool ethically approved study will have insurance cover.

Will my taking part in the research study be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential, and any information about you which leaves the surgery will have your name and address removed so that you cannot be recognised. Your name will not appear in any part of the final research report.

Involvement of your General Practitioner

You may have been referred to the study via your GP or via another health professional in the student health practitioner. If you decide to take part in the study we will not inform them of your involvement in the study or of any results.

What will happen to the results of the research study?

The results obtained from the research study will be written up as part of a qualification at The University of Liverpool for a Doctorate in Clinical Psychology. In addition, the findings may be published in a peer reviewed academic journal. Your name will not appear in any part of the report or any publications that are produced. If you wish to find out the results from the study you can contact c.malone@liverpool.ac.uk after September 2013.

Who is organising and funding the research?

Mersey Care NHS Trust are funding the research you have been asked to take part in.

Who has reviewed the study?

All research in the NHS is looked at by independent group of people, called a Research Ethics Committee, to protect your interests. The study has also been approved by a University of Liverpool ethics committee.

Who can I contact if I have further questions?

If you have any further questions after reading this information sheet please contact Catherine Malone at c.malone@liverpool.ac.uk.



CONSENT FORM: Autobiographical memory and depression

Centre Number:

Study Number:

Patient Identification Number for this trial:

Name of Researcher: Dr Catherine Malone

Name of Supervisors: Dr James Reilly, Professor Mark Howe.

Chief investigator: Dr James Reilly

Please initial box:

1. I confirm that I have read and understand the information sheet dated 30.10.11 (version 1.1) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

3. I understand that data collected during the study may be looked at by individuals from The University of Liverpool, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data.

4. I agree to take part in the above study.

Name of Patient..... Date..... Signature.....

Name of Person..... Date..... Signature.....
taking consent

When completed: 1 for participant; 1 for researcher site file