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The Distinct Contributions of Affective Distress and Personality to Memory Complaints Made in Older Adulthood

Matthew Robert Merema
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The Distinct Contributions of Affective
Distress and Personality to Memory
Complaints Made in Older Adulthood

Matthew Robert Merema

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The Distinct Contributions of Affective Distress and Personality to Memory Complaints Made in Older Adulthood

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7th July, 2014

This thesis is presented in fulfilment of the requirements for the award of Doctor of
Philosophy (Clinical Psychology)

Principal Supervisor: Professor Craig P. Speelman

Associate Supervisor: Dr Elizabeth A. Kaczmarek

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*“If our brains were simple enough for us to understand them,
we'd be so simple that we couldn't.”*

~ Ian Stewart ~

ABSTRACT

Whilst a substantial amount of research has investigated the role of affective distress and features of personality in memory complaints made by older adults, little effort has been directed towards understanding their distinct contributions to complaints. Given considerable overlap between affective distress and features of personality, such evidence is necessary to inform theoretical frameworks pertaining to memory complaints and clarify results from other empirical studies examining these concepts. Consequently, the current study examined symptoms of depression and anxiety as predictors of memory complaints within the context of features of personality and other relevant contextual variables (i.e., age, gender, education, premorbid intellectual functioning and memory performance) utilizing a correlational design. Study participants included 177 (115 females, 62 males) community-dwelling older adults between 65 and 90 years of age. The results of the study unanimously suggested that affective distress (i.e., depressive and anxiety symptomatology) was not associated with memory complaints beyond pertinent features of personality and other relevant contextual variables. This finding was consistent regardless of how memory complaints were assessed (i.e., General Frequency of Forgetting scores or via a global, dichotomous measure) or how affective distress was conceptualized (i.e., overall or specific features of depression and anxiety). The results suggest changes to several theoretical frameworks in the memory complaint literature are necessary, if the results can be replicated with different variable measures. From a clinical perspective, the results of the current study suggest older adults complaining of memory difficulties may exhibit an ongoing risk of symptoms of depression and anxiety. In addition, the results also help to clarify why cognitively-healthy older adults who complain of memory problems exhibit an increased risk of subsequent dementia.

CHAPTER HEADINGS

Chapter	Title
1	INTRODUCTION
2	COMPLAINTS, PERFORMANCE AND AFFECTIVE DISTRESS
3	THE ROLE OF PERSONALITY
4	THEORETICAL ACCOUNTS OF MEMORY COMPLAINTS
5	THE CURRENT STUDY
6	METHODOLOGY
7	ANALYSIS AND RESULTS
8	DISCUSSION

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FREQUENTLY ABBREVIATED TERMS

DASS	Depression Anxiety Stress Scales
GFF	General Frequency of Forgetting
LM	Logical Memory
LM-I	Logical Memory 1
LM-II	Logical Memory 2
MFQ	Memory Functioning Questionnaire
NART	National Adult Reading Test
NEO-FFI	NEO Five-Factor Inventory
VR	Visual Reproduction
VR-I	Visual Reproduction 1
VR-II	Visual Reproduction 2
WMS	Wechsler Memory Scale
WMS-III	Wechsler Memory Scale – Third Edition
WMS-IV	Wechsler Memory Scale – Fourth Edition

SECTION ONE

CHAPTER 1

INTRODUCTION

Key Points Addressed in Chapter One

- Many older adults report problems with their memory, despite such reports typically showing only weak relationships with objective memory performance.
- Memory complaints appear to be more robustly associated with affective distress and aspects of personality.
- Despite a clear association between affective distress and features of personality, little effort has been invested in disentangling this association in the context of memory complaints in older adults.
- This thesis attempts to clarify the unique contribution of affective distress to memory complaints beyond the role of personality.
- The results of the research have theoretical and clinical implications and will assist with the interpretation of studies previously examining predictors of memory complaints.
- To achieve its aims, the research described in this thesis incorporates two patterns of affective distress (symptoms of depression and anxiety) and five features of personality (those comprising the Five Factor Model of Personality).
- The thesis has two sections: section one reviews relevant empirical and theoretical literature; section two details the current study and ensuing discussion.

CHAPTER 1: Introduction

Whilst research investigating the epidemiology of memory dysfunction in older adults is currently making considerable headway, memory-related problems still present a key concern of older adults to the extent that they exceed concerns associated with death and dying (Dark-Freudeman, West, & Viverito, 2006). Recent estimates suggest that approximately two-thirds of community-dwelling older adults between 70 and 90 years of age report difficulties with their memory as well as a decline in function over the previous 10 years (Slavin et al., 2010). However, such self-reports of memory difficulties are inconsistently associated with concurrent memory performance (Hertzog & Pearman, 2014; Reid & MacLulich, 2006) and discerning their primary source(s) has proven challenging. In fact the complexity that underlies memory complaints in older adulthood, coupled with the potential value of understanding them, has given rise to 25 years of persistent research efforts with few significant breakthroughs.

Considerable research effort has been expended on examining whether memory complaints are predictive of memory performance or other associated factors, including general cognitive functioning, age, medical conditions (e.g., stroke), dementia diagnoses and a range of other variables (for a review, see Reid & MacLulich, 2006). Despite such efforts, few factors have been found to be consistently related to memory complaints. For example, some studies have reported weak associations between memory complaints and memory performance on psychometrically-validated tests of cognitive function (Jonker, Launer, Hooijer, & Lindeboom, 1996; Lam, Lui, Tam, & Chiu, 2005), whilst others have reported no such association (Jungwirth et al., 2004; O'Connor, Pollitt, Roth, Brook, & Reiss, 1990; Pearman & Hertzog, in press). Similarly, other studies have found memory complaints to be predictive of subsequent cognitive decline (Dik et al., 2001; Jorm, Christensen, Korten, Jacomb, & Henderson, 2001) and dementia (Schmand, Jonker, Hooijer, & Lindeboom, 1996; Wang et al., 2004), whilst others have not (Jorm et al., 1997; Smith, Petersen, Ivnik, Malec, & Tangalos, 1996; Taylor, Miller, & Tinklenberg, 1992).

In contrast, more recent literature suggests memory complaints are most robustly associated with aspects of affective distress, particularly depression or symptoms of it. Several studies have reported this link (e.g., Dux et al., 2008; Pearman & Hertzog, in press; Potter, Hartman, & Ward, 2009; Slavin et al., 2010) and whilst the strength of the relationship differs according to the measures of depression and complaints used, few (if any) published studies have reported the absence of a significant zero-order relationship between them (although publication bias may play a role here). Likewise, a number of studies have also reported associations between memory complaints and anxiety (Jungwirth et al., 2004; Lautenschlager, Flicker, Vasikaran, Leedman, & Almeida, 2005; Potter & Hartman, 2006), suggesting memory complaints may be more closely tied to forms of affective distress than the presence of any objective memory or cognitive impairment.

Alternatively, a handful of studies have also highlighted associations between memory complaints and more stable, enduring aspects of personality (Kliegel, Zimprich, & Eschen, 2005; Pearman & Hertzog, in press; Pearman & Storandt, 2004, 2005). For example, studies by Pearman and Storandt (2004) and Kliegel et al. both found memory complaints to be significantly associated with neuroticism, a fundamental personality trait of the Five-Factor Model of Personality (McCrae & Costa, 1987; McCrae & Oliver, 1992). Pearman and Storandt (2005) then extended this in a later study, suggesting memory complaints were most closely associated with a single facet of conscientiousness (self-discipline) and two facets of neuroticism (self-consciousness and anxiety). Consequently, Pearman and Storandt (2005) concluded that assistance for older adults with memory complaints should focus on enhancing self-discipline and self-concept.

Despite such studies into personality characteristics and features of affective distress as predictors of memory complaints, little consideration has been given to the overlap between them. It has been widely observed that characteristics of personality are associated with both depression (Bagby, Quilty, & Ryder, 2008; Klein, Kotov, & Bufferd, 2011) and anxiety (Kotov, Gamez, Schmidt, & Watson, 2010; Kotov, Watson, Robles, & Schmidt, 2007; Middeldorp et al., 2006). For example, a recent review by Klein et al. suggests depression is related to several

aspects of personality, including neuroticism, extraversion and conscientiousness. Likewise, an earlier review by Middeldorp et al. found anxiety to be consistently associated with neuroticism and extraversion. Whilst there is still considerable debate about whether or not the relationship between personality characteristics and affective distress is a causal one (see Andersen & Bienvenu, 2011; Klein et al., 2011), there is undeniably a range of strong associations between them (discussed further in Chapter 3).

It is this overlap between personality and features of affective distress and its impact on the predictability of memory complaints in older adults that forms the basis of this thesis. Perhaps the most notable limitation of literature evaluating the association between affective distress and memory complaints is the extent to which this relationship exists beyond more stable, long-term aspects of personality. There is currently little or no literature available that has examined whether affective distress is predictive of memory complaints beyond what can already be explained by characteristics of personality (although see Appendix A).

Addressing this gap in the literature is important for several reasons. Firstly, it has been widely observed that memory complaints are one of the key indicators of depression in older adult populations (indeed, it has been incorporated into the Diagnostic and Statistical Manual of Mental Disorders [DSM-5] criteria for Major Depressive Disorder, American Psychiatric Association, 2013). However, without research considering the concurrent role of personality, it remains unclear whether or not the relationship reported in the literature is of a direct nature. One only needs to examine the relationship between ice cream sales and drowning rates (both of which can be attributed to seasonal weather patterns) to understand that correlated variables are not necessarily directly connected in any meaningful way. Secondly, such research would have implications for theory attempting to address predictors of memory complaints, given personality factors have been largely overlooked to this point. Thirdly, and arguably most importantly, the results would have clinical implications for mental health screening and for better understanding the nature of memory complaints in older adulthood.

Consequently, the aim of the current study and of this thesis is to address the relationship between features of affective distress and personality in the prediction of memory complaints in older adults by observing whether symptoms of depression and anxiety (which research suggests are associated with memory complaints) remain useful predictors beyond characteristics of personality. This includes both general measures of affective distress (i.e., overall measures of depression and anxiety as predictors of memory complaints) as well as specific self-reported elements of depression (e.g., feelings of hopelessness) and anxiety (e.g., physiological arousal). In the study reported in the latter section of this thesis, these relationships were observed within the context of personality characteristics defined by the Five-Factor Model of Personality (McCrae & Costa, 1987; McCrae & Oliver, 1992) and a range of other pertinent factors, including performance on psychometrically-validated tests of memory, age, gender, education and premorbid intellectual functioning.

To achieve the aim of this study, the thesis brings together select bodies of literature primarily from the fields of clinical psychology, neuropsychology and personality psychology. Structurally, the thesis is divided into two sections, consisting of three and four chapters, respectively. Section one provides the relevant background literature to the study reported in section two. It begins by examining literature investigating the associations between memory complaints, memory performance and affective distress (Chapter 2). This is followed by a discussion of literature examining the role of personality via its associations with memory complaints and affective distress (Chapter 3). The final chapter of section one provides a concise summary of four theories that address memory complaints that have made specific mention of affective distress and/or characteristics of personality (Chapter 4). At the conclusion of section one, a summary is provided that revisits the key points.

Section two then addresses the current study and begins with a discussion of the objectives and their rationale, and provides the questions to be answered in the research (Chapter 5). This is followed by a methodology section (Chapter 6), which details the sample utilized in the study (including how participants were selected),

the apparatus used to collect the data and the research procedures. A section detailing the analyses and results is then presented (Chapter 7). This section begins by presenting the specific analyses utilized in the study and addresses the relevant assumptions of these analyses. This is followed by two sets of preliminary analyses that address the selection of relevant personality characteristics and the formation of memory performance variables that are incorporated into the main analyses.

The main analyses then follow, which first address depression as a predictor of memory complaints beyond personality and a range of other variables (both for overall depression and specific symptoms, such as inertia). Separate regression models are produced for both applied and globally-measured memory complaints. This is followed by analyses examining anxiety as a predictor of memory complaints beyond personality (again, both for overall anxiety and specific symptoms, such as physiological arousal). The Discussion section is presented last (Chapter 8) and begins with a detailed synopsis of the results within the context of the research questions and previous literature. The theoretical and clinical implications of the results are then discussed, followed by the limitations of the current study. The thesis concludes with a discussion of new avenues for research and an overall summary.

CHAPTER 2

COMPLAINTS, PERFORMANCE AND AFFECTIVE DISTRESS

Key Points Addressed in Chapter Two

- Until recently, associations with memory performance and affective distress have dominated research into subjective memory complaints.
- Chapter 2 discusses empirical literature and relevant reviews investigating the extent to which each of these three factors are associated with one another.
- In the majority of published studies utilizing established measures of memory complaints, complaints typically show only a weak association with objective memory performance.
- As with research utilizing established measures of memory complaints, studies using short, global assessments of memory complaints typically show a weak association with objective memory performance.
- Reviews and meta-analyses have demonstrated that depression is associated with poorer performance on a range of memory tasks.
- Reviews and meta-analyses have demonstrated that anxiety is associated with poorer memory performance; however, these deficits appear to be limited to specific information, such as verbal and episodic information, rather than representing a universal cognitive impairment.
- Research has demonstrated that memory complaints are associated with depression (or symptoms of it), regardless of whether established questionnaires or simple global questions of memory complaints are utilized.
- Likewise, research has also demonstrated that memory complaints are associated with anxiety (or symptoms of it), regardless of whether established questionnaires or simple global questions of memory complaints are utilized.

CHAPTER 2: Complaints, Performance and Affective Distress

As mentioned in the previous chapter, considerable effort has been expended over the past 25 years on attempts to understand memory complaints and delineate the important predictors of them. A number of studies have examined the relationship between memory complaints and memory performance, motivated predominantly by the potential value of such complaints as an indicator of actual memory problems. Research stemming from the fields of clinical psychology and neuropsychology has also provided several studies on memory performance within the context of affective distress, which presents itself as a key factor in the context of memory complaint research. Over the past two decades, however, the memory complaint literature has shifted considerably, focussing extensively on aspects of affective distress that co-occur with complaints of memory problems. Such studies have not only changed the interpretation of memory complaints but have important implications for mental health screening in older adults with memory concerns (see Harwood, Barker, Ownby, Mullan, & Duara, 2004).

A range of other factors that may be associated with memory complaints have also been examined, including brain structure (Jorm et al., 2004; Minett, Dean, Firbank, English, & O'Brien, 2005), education (Levy-Cushraan & Abeles, 1998) and recall strategies (Seelye et al., 2007). In addition, research has also examined memory complaints within specific clinical sub-groups, such as stroke patients (Aben et al., 2011) and individuals who are HIV-positive (Au et al., 2008; Chan et al., 2007). However, the bulk of the literature has targeted the relationships between memory complaints, memory performance and affective distress (primarily depression and anxiety). Given the prominence of these relationships in the literature and their relevance to this thesis, this chapter focuses on research that has examined these relationships.

Literature that has examined the relationship between memory complaints and memory performance is reviewed initially. A detailed synthesis and summary of relevant studies is provided for this section because few or no relevant reviews (narrative or meta-analytic) are currently available on this topic. Following this, the chapter shifts focus to the relationship between memory performance and two forms

of affective distress (i.e., depression and anxiety). A more established literature base exists for the relationship between memory performance and these two forms of affective distress, which includes several narrative and meta-analytic reviews on this topic. Consequently, for the purpose of maintaining a comprehensive yet concise synthesis of the literature, the section detailing these relationships provides a concise review of the more pertinent reviews rather than providing detailed summaries of individual studies available on this topic. In the final section of this chapter, a review is provided for the relationship between memory complaints and both forms of affective distress (i.e., depression and anxiety). As with the relationship between memory complaints and memory performance, few reviews that focus exclusively on the relationship between memory complaints and affective distress are available (although they are discussed as part of much broader reviews, see Hertzog & Pearman, 2014; Reid & MacLulich, 2006). Consequently, a detailed synthesis and summary of relevant studies is also provided for this section.

Memory Complaints and Memory Performance

Whilst research into memory complaints is young in the context of many other fields of psychology, literature examining the relationship between memory complaints and memory performance has developed exceptionally quickly in a short period of time. In order to limit the review of literature to studies relevant to this thesis, a number of inclusion criteria were utilized for studies in the following section (see Table 1). First, studies needed to include one or more measures of memory complaint and one or more measures of memory performance (e.g., studies incorporating only measures of more general cognitive performance were not included). Second, given the purpose of this chapter is partly to examine whether memory complaints and memory performance are related, only studies that provide zero-order relationships between these factors were included (e.g., studies providing only semi-partial correlations or group differences corrected for other variables were not included). Third, given this thesis focusses on concurrent relationships between memory complaints, memory performance, affective distress and personality, only studies reporting on cross-sectional (i.e., not longitudinal) relationships are reviewed here. Fourth, because the research reported in this thesis focuses on a community sample, only studies reporting on community samples were included here. That is,

studies focusing exclusively on cognitively-impaired individuals (e.g., dementia or mild cognitive impairment) or other specific sub-groups (e.g., only individuals with clinically-diagnosed depression) were not included. Finally, because this thesis focuses on older adults, only studies incorporating older adult samples were examined (e.g., studies only including samples younger than 50 years were not included).

Table 1

Criteria for Studies that Reviewed Memory Complaints and Memory Performance

1. One or more measures of both memory complaints and memory performance
2. Zero-order relationship(s) between complaint and performance measures
3. Cross-sectional (i.e., not longitudinal) relationships
4. Community samples, not solely clinical populations
5. Includes a large proportion of older adults (e.g., adults over 50 years of age)

A total of 18 studies examining memory complaints that met the above criteria were identified. Ten of these studies utilized applied memory complaint questionnaires (i.e., those examining complaints in an applied context, such as recalling phone numbers). The remaining eight studies utilized more global measures of memory complaints. In all studies but one, global measures of complaints were assessed via four or fewer questions. Given such measures may give rise to stronger or weaker relationships with memory performance and that this issue has not been adequately addressed in the literature, the following section examines these studies separately.

Questionnaire Assessments of Memory Complaints

The median size of the 13 samples included in the 10 studies examining the relationship between memory performance and applied memory complaint questionnaires was 117, ranging from 25 up to 364 participants. Six studies used more than one measure of memory performance and two studies used more than one

memory complaint questionnaire. Of the 10 studies, seven identified at least one significant association between memory performance and memory complaints in the expected direction. Listed in Table 2 are the 10 studies with sample size and age range (or mean age), measures of memory performance and memory complaints used and whether the study identified a link between them in the expected direction (i.e., more severe complaints with poorer performance).

Table 2

Questionnaire Studies Examining Memory Complaints and Memory Performance

Study	N/n (age)	Memory Measure	Complaint Measure	Association (Yes / No)
Derouesne et al. (1999)	183 (50+)	Multiple	SMS	Yes
Devolder & Pressley (1991)	48 ($M = 70.9$) 48 ($M = 68.6$)	Multiple	MQ	No No
Dux et al. (2008)	130 (65+)	RAVLT	GFF	Yes
Hertzog et al. (2000)	121 (35-84)	Multiple	MFQ	Yes
Levy-Cushraan et al. (1998)	130 (47-90)	RBMT	MAC-S	Yes
Mendes et al. (2008)	292 (18-87)	CVLT	MCS	No
Minett et al. (2005)	60 (64-84)	Multiple	MCQ	Yes
Schmidt et al. (2001)	117 (46-89) 111 (45-85)	Multiple	GMFQ	Yes No
Scogin (1985)	59 (60-82) 25 (60-75)	Multiple	MQ	Yes No
Zeintl et al. (2006)	364 (65-80)	Red Pencil	CSMAQ	Yes

Note: CSMAQ = Capacity Scale of the Metamemory in Adulthood Questionnaire, CVLT = California Verbal Learning Test, GFF = General Frequency of Forgetting Scale, GMFQ = Groningen Memory Failures Questionnaire, MAC-S = Memory Assessment Clinics Self-Rating Scale, MCQ = Memory Complaint Questionnaire, MCS = Memory Complaints Scale, MFQ = Memory Functioning Questionnaire, MQ = Metamemory Questionnaire, RAVLT = Rey Auditory Verbal Learning Task, RBMT = Rivermead Behavioral Memory Test, SMS = Subjective Memory Scale.

Early small-scale studies suggested that if memory performance was associated with responses on memory complaint questionnaires, the relationship was relatively weak (Devolder & Pressley, 1991; Scogin, 1985). Initially, a study by

Scogin indicated that memory complaints (assessed via the Metamemory Questionnaire, Zelinski, Gilewski, & Thompson, 1980) may be vaguely indicative of poorer memory performance. In samples of high ($n = 59$) and low ($n = 25$) memory complainers between 60 and 82 years of age, Scogin reported no significant differences between the groups on the Benton Visual Retention Test (Benton, 1974), Digit Span (Wechsler, 1981) or on immediate or delayed measures of recalling 20 nouns, 15 grocery items or the names of 15 people associated with photographs. Within each of the groups, canonical correlations between all memory measures and all questions on the Metamemory Questionnaire did not reach significance for either group (although one could assume that, given the size of the samples and the strength of the relationship, low statistical power played a role in this result). However, several measures of memory correlated weakly ($r = -.26$ to $-.36$)¹ but significantly with specific questions on the Metamemory Questionnaire in the high memory complaints group.

Despite these relationships, another early small-scale study by Devolder and Pressley (1991) demonstrated no association between memory complaints and memory performance. In two groups of older adults, no evidence was found for a link between memory complaints measured via a subset of items from the Metamemory Questionnaire (Zelinski et al., 1980) and memory performance on noun recall and recognition tasks, a face-name learning task, and an appointment-keeping task. For sample one ($n = 48$, $M_{\text{age}} = 70.9$ years), no differences in performance on the noun recall or recognition tasks were found between those with low, moderate and high levels of memory complaints. In sample two ($n = 48$, $M_{\text{age}} = 68.6$ years), no difference was found for face-name learning or on an appointment-keeping task either.

More recent small-scale studies have suggested equally-weak relationships between memory complaints and memory performance. Minett, Dean, Firbank, English and O'Brien (2005), for example, examined correlations between scores on the Memory Complaint Questionnaire (Crook, Feher, & Larrabee, 1992) and

¹ Given differences in how variables are measured and scored, effect sizes reported throughout this thesis differ in direction. However, unless specified otherwise, effect sizes were in the expected direction.

performance on category fluency (animals), a digit span task, the Logical Memory (LM) subtest from the Wechsler Memory Scale-Third Edition (WMS-III, Wechsler, 1997), and the Visual Reproduction (VR) Test (Williams, 1991). In a sample of 60 older adults between 64 and 84 years of age, Minett et al. (2005) reported that higher scores (i.e., more complaints) on the Memory Complaint Questionnaire was significantly associated with poorer category fluency (animals) performance ($r = -.28, p = .031$). Scores on the digit-span, LM and VR tasks were all in the expected direction but failed to reach significance. Thus, the study suggests memory complaints may exhibit a relationship with memory performance on some tasks, albeit very weak.

In terms of statistical significance, larger studies provide a much more consistent relationship between memory complaints and memory performance. Of five studies on memory complaints comprising samples between 100 and 200 participants (Derouesne et al., 1999; Dux et al., 2008; Hertzog et al., 2000; Levy-Cushraan & Abeles, 1998; Schmidt et al., 2001), four have identified a significant relationship between complaints and performance. Dux et al., for example, examined whether responses on the Frequency of Forgetting Scale from the Memory Functioning Questionnaire (MFQ, Gilewski, Zelinski, & Schaie, 1990) were associated with immediate and delayed recall performance on the Rey Auditory Verbal Learning Task (Rey, 1964). In a sample of 130 individuals over the age of 65 years, Dux et al. reported significant relationships with both immediate ($r = .30, p < .001$) and delayed ($r = .24, p < .001$) recall performance.

Likewise, Levy-Cushraan and Abeles (1998) also obtained significant relationships between measures of memory complaints and memory performance. In a sample of 130 individuals aged between 47 and 90 years, the study examined correlations between scores on the Rivermead Behavioral Memory Test (Wilson, Cockburn, Baddeley, & Hiorns, 1989) and scores on the Memory Assessment Clinic's Self-Rating Scale (MAC-S, Winterling, Crook, Salama, & Gobert, 1986), which incorporates two subscales pertaining to (1) memory abilities and (2) how frequently memory problems are encountered. Levy-Cushraan and Abeles reported significant relationships of memory performance with overall MAC-S scores ($r = .19, p < .05$) as well as with scores on the abilities ($r = .22, p < .01$) and frequency (r

= .18, $p < .05$) subscales. The results reported by Levy-Cushraan and Abeles as well as Dux et al. (2008) indicate that memory complaints and memory performance may indeed exhibit a relationship between them, though this relationship may be too weak to pick up with smaller sample sizes due to a lack of statistical power.

Derouesne et al. (1999) found further support for a weak relationship between memory complaints and memory performance in older adults over 50 years of age. The study examined memory complaints in the context of performance on the Visual Retention Test (Benton, 1974), the Rey Auditory Verbal Learning Test (Rey, 1964) and an adapted version of the LM Test (Wechsler, 1945). The study found that memory performance was not significantly correlated with overall memory complaints on the Subjective Memory Scale (Derouesne et al., 1989) for any of the measures, though older adults who reported 'major' concerns about their memory performed more poorly on the Rey Auditory Verbal Learning Test than older adults who reported only 'minor' concerns. Furthermore, older adults who scored below a given threshold on all three tasks rated their memory as significantly poorer than older adults who scored above the threshold on all three tasks (at $p < .001$). Thus, whilst memory complaints may only weakly correlate with memory performance across community samples, they may be of some use in discriminating between consistently high and low memory performance on well-validated memory assessments.

Hertzog et al. (2000) found relatively consistent relationships between memory complaints derived from various subsets of items from the MFQ (Gilewski et al., 1990) and several measures of memory. Hertzog et al. assessed memory complaints in 121 adults between 35 and 84 years of age via the general rating of memory scale, the mnemonics scale and through three frequency of forgetting subscales (pertaining to complaints about prospective, retrospective and working memory) formed by combining various individual items from the Frequency of Forgetting Scale. Amongst a wide range of memory tasks, immediate and delayed performance on a 50-item free recall task showed consistent associations with complaints on the prospective memory ($r = .29$ and $.33$, respectively), retrospective memory ($r = .33$ and $.31$, respectively) and working memory ($r = .32$ and $.23$,

respectively) complaint subscales. The general rating of memory scale also correlated with immediate and delayed free recall performance, though to a lesser extent ($r = .20$ and $.13$, respectively). Mnemonics usage was weakly and negatively correlated with delayed free recall ($r = -.17$) but not with immediate free recall ($r = -.02$). Thus, memory performance may also be correlated with specific types of memory complaints but less so to more general ratings of memory and the use of mnemonics.

Further evidence for weak correlations between memory complaints and memory performance was provided by Schmidt et al. (2001) in a study of adults aged 45-89 years. In one sample ($n = 117$), correlations between 12 measures of memory performance and subjective reports of current memory failures (assessed via the Groningen Memory Failures Questionnaire, Schmidt, Zwart, Berg, & Deelman, 1999) ranged from $.09$ to $-.26$ (mean $r = -.15$). Whilst none of the correlations reached significance, 10 out of 12 were in the expected direction (i.e., negative). Subjective reports of changes in memory failures were more consistently associated with performance and whilst only two of 12 correlations reached significance, all were in the expected direction (mean $r = -.22$, range = $-.11$ to $-.36$). In a second sample ($n = 111$), however, Schmidt et al. found that subjective reports of memory failures showed little or no relationship with various laboratory or ecological memory tests. Again, correlations were generally in the expected direction, though too weak in this case to provide evidence of any consistent relationship between memory complaints and memory performance (mean $r = -.06$, range = $.00$ to $-.13$).

Two further studies with samples of 292 adults (Mendes et al., 2008) and 364 older adults (Zeintl et al., 2006) have also examined the link between memory complaints and memory performance. Most recently, Mendes et al. found no link between memory complaints (assessed via the Subjective Memory Complaints scale, Schmand et al., 1996) and performance on the 20-minute delay free recall component of the California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 1987). Despite the larger sample size, Mendes et al. found no significant relationship between these two measures ($r = .01$, $p = .865$). Furthermore, the association

between complaints and performance did not reach significance for any age groups when examined within participants grouped by decade (e.g., 20-30 years).

However, consistent with previous work by Hertzog et al. (2000), Zeintl et al. (2006) also reported a significant relationship between memory complaints and prospective memory performance. In a study of 364 older adults between 65 and 80 years of age, Zeintl et al. examined correlations between prospective memory complaints (assessed via the Prospective and Retrospective Memory Questionnaire, Smith, Del Sala, Logie, & Maylor, 2000) and performance on the Red Pencil task (Dobbs & Rule, 1987; Salthouse, Berish, & Siedlecki, 2004); a simple measure of prospective memory whereby the participant is given instructions at the beginning of the testing session to repeat the words “Red Pencil” whenever spoken by the researcher conducting the session. No significant difference was reported between high ($n = 197$) and low ($n = 167$) memory complainers (determined via the median score on the Prospective and Retrospective Memory Questionnaire), although a weak but significant relationship ($r = .21, p < .01$) was observed between performance and complaints in the low complainers group. Based on these results, Zeintl et al. concluded that prospective memory complaints may be a useful indicator of prospective memory performance in older adults with relatively few symptoms of depression (since low complainers exhibited fewer symptoms of depression).

Global Assessments of Memory Complaints

Another eight studies have been conducted examining the association between memory complaints and memory performance using less detailed, global assessments of complaint. Table 3 lists the studies, sample size and age range, measures of memory performance used, number of questions used to assess memory complaints and whether or not the study identified a link between complaints and performance. Samples in these eight studies tended to be considerably larger, with several exceeding 500 participants as well as two very large scale studies incorporating samples of 2546 (Jorm et al., 2004) and 16964 (Amariglio, Townsend, Grodstein, Sperling, & Rentz, 2011) participants. The median sample size was 476, ranging from 114 up to 16964. Four of the seven studies used multiple measures of memory performance and the number of questions used to assess memory

complaints ranged from one to seven. Of the eight studies, seven identified at least one significant association between memory complaints and memory performance in the expected direction.

Table 3

Global Assessment Studies Examining Memory Complaints and Performance

Study	N/n (age-years)	Memory Measure	Complaint Questions	Association (Yes / No)
Amariglio et al. (2011)	16964* (70-81)	TISC	7	Yes
Bassett & Folstein (1993)	810 (18-92)	MMSE	1	Yes
Jorm et al. (2004)	2546 (60-64)	CVLT	3	Yes
Jungwirth et al. (2004)	302 (75)	FOME	4	No
Minett et al. (2008)	114 (50+)	Multiple	2	Yes
Riedel-Heller et al. (1999)	349 (75+)	SIDAM	2	Yes
Snitz et al. (2008)	276 (65+)	Multiple	1	Yes
Zandi (2004)	603 (47-93)	CAMCOG	4	Yes

*All participants were female

Note: CAMCOG = Cambridge Assessment of Mental Disorders in the Elderly, CVLT = California Verbal Learning Test, FOME = Fuld Object Memory Evaluation, MMSE = Mini-Mental State Examination, SIDAM = Structured Interview for the Diagnosis of Dementia of Alzheimer Type, Multi-Infarct Dementia and Dementias of Other Etiology, TISC = Telephone Interview for Cognitive Status.

A relatively recent study by Minett, Da Silva, Ortiz and Bertolucci (2008) examined memory complaints in 114 older adults over 50 years of age. Participants were grouped into complainers and non-complainers on the basis of their responses to two questions: “Do you currently have any problems with your memory?”, and if so, “Are these problems interfering with your normal life?” Participants were deemed ‘complainers’ if they responded with yes to both of these questions. Minett et al. then compared these two groups on a number of performance measures, including the Rey Auditory Verbal Learning Test (Rey, 1958), the VR Test

(Williams, 1991), an adapted version of the LM subtest (Wechsler, 1997), the Free and Cued Selective Reminding Test (Buschke, 1984) and two category fluency tests (animals and fruits). Mean scores for non-complainers were higher than for complainers on all measures except for the LM subtest, though a statistically significant difference between the groups was observed only on the category fluency-animals task. Thus, even when individuals judge that memory problems are interfering with day-to-day life, they likely offer little predictive value for identifying differences in memory performance on well-validated neuropsychological assessments of memory.

Medium-size studies examining global memory complaints have provided mixed results regarding the relationship between memory complaints and memory performance, with two studies finding an association (Riedel-Heller et al., 1999; Snitz et al., 2008) and a third study finding no association (Jungwirth et al., 2004). Riedel-Heller et al. initially reported in a sample of 349 older adults over 75 years of age that measures relating to memory from the SIDAM (Structured Interview for the Diagnosis of Dementia of Alzheimer Type, Multi-Infarct Dementia and Dementias of Other Etiology, Zaudig et al., 1991) were associated with the severity of memory complaints to some degree. Participants were allocated to one of four memory complaint groups according to responses to two questions that assessed whether participants had any problems with their memory (yes or no), and if so, whether these problems occurred seldom, often, or always. The results indicated that long-term memory performance was not significantly related to complaints ($p = .645$) but was worse in participants in the ‘always’ complaints group. Immediate recall was not significantly related to complaints ($p = .052$) but small, gradual decreases in performance were observed across increasing severity of complaints. Furthermore, short-term recall was significantly related to complaints ($p = .004$). Thus, memory performance appeared to be related to complaints but was much more evident in some measures of memory performance than others.

More recently, however, Jungwirth et al. (2004) reported no relationship between memory complaints and memory performance in a similarly-sized study using a different measure of memory. Memory performance was assessed via a

slightly modified version of the Fuld Object Memory Evaluation (Fuld, 1981). Those scoring more than 1.5 standard deviations below the mean of the sample were categorised as having an objective memory impairment. Participants were also coded as ‘complainers’ or ‘non-complainers’ on the basis of their responses to four questions, which assessed complaints about changes in everyday memory over the past 2.5 years (e.g., “Are you worse at remembering where belongings are kept?”). Jungwirth et al. reported that only one of 32 complainers (3.1%) exhibited impaired memory performance, compared with 15 of 270 non-complainers (5.6%) who exhibited impaired memory performance. Jungwirth et al. therefore suggested that objective memory performance is not associated with retrospective complaints of worsening everyday memory.

More recently again, Snitz et al. (2008) reported weak but very consistent associations between memory performance and memory complaints. In a study of 265 older adults over 65 years of age, Snitz et al. categorized participants into one of three groups based on their response to the question, “In general, how do you feel your memory is for a person your age?” (‘Excellent’, ‘Good’ or ‘Fair/Poor’). Memory performance was assessed via three instruments that each provided a measure of immediate and delayed recall: the Word List Learning Test (Morris et al., 1989), the LM subtest (Wechsler, 1987) and the Rey-Osterrieth Figure Test (Becker, Boller, Saxton, & McGonigle-Gibson, 1987). Snitz et al. observed significant differences in memory performance across memory complaint groups on all six measures. The results show progressive declines in memory performance with increases in complaint severity, apart from delayed recall on the Rey-Osterrieth Figure Test, for which the ‘Good’ group slightly outperformed the ‘Excellent’ group (both of which outperformed the ‘Fair/Poor’ group).

Two larger studies by Bassett and Folstein (1993) and Zandi (2004) both reported associations between memory complaints and memory performance. In Bassett and Folstein’s study, a community sample of 810 adults aged 18 to 92 years were each asked, “Do you find that you have trouble with your memory?”, to which participants either responded with ‘yes’ (22.1%) or ‘no’ (77.9%). As a simple measure of memory performance, the study utilized responses from the 3-item

delayed recall question from the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975). Participants who recalled two or three of the items were deemed to have good recall, whilst those who recalled zero or one of the items were deemed as having poor recall. Across the entire sample, 68% of participants accurately reported their memory performance (i.e., exhibited poor recall and reported trouble with their memory or exhibited good recall and reported no trouble with their memory). A point-biserial correlation indicated a significant but modest relationship between the two variables ($r = .21, p < .05$).

The more recent study by Zandi (2004) examined memory complaints in 603 adults aged between 47 and 93 years. Participants were asked four questions about their memory: (1) “Do you have any difficulty with your memory?”, (2) “Do you forget where you have left things more than you used to?”, (3) “Do you forget the names of close friends and relatives?”, and “Have you been in your town and neighbourhood and forgotten your way?” Memory complaints were scored as the total number of “yes” responses to the set of questions (0-4). These scores were then examined against total scores across three measures of memory (‘recent’, ‘remote’ and ‘learning’ memory) on the CAMCOG component of the CAMDEX (Cambridge Assessment of Mental Disorders in the Elderly, Roth et al., 1986). A significant correlation of comparable size to that reported by Bassett and Folstein (1993) was reported ($r = .134, p < .01$).

Finally, two very large scale studies also provide evidence of a weak association between memory complaints and memory performance (Amariglio et al., 2011; Jorm et al., 2004). Jorm et al. conducted a comprehensive study of 2546 older adults aged from 60 to 64 years. As part of a vast psychological and neuropsychological battery, participants completed the immediate and delayed recall components of the California Verbal Learning Test (Delis et al., 1987). Memory complaints were assessed via responses to global memory complaint questions; for example, “Do you feel you remember things as well as you used to? That is, is your memory the same as it was earlier in life?” Jorm et al. reported a significant difference between those who did and did not complain of memory problems on both the immediate and delayed memory performance measures (both $p < .001$). This result is perhaps not surprising, however, given the size of the sample and power of

the analysis. Cohen's d values indicated a relatively small difference between the groups on both the immediate ($d = 0.32$) and delayed measures ($d = 0.33$) of memory performance.

Some of the strongest evidence for a relationship between memory complaints and memory performance comes from a very large scale study conducted recently by Amariglio et al. (2011). In a study of almost 17,000 women aged between 70 and 81 years, Amariglio et al. examined memory complaints in seven different contexts, including whether or not their memory abilities had changed, whether or not they experienced more difficulty remembering short lists of items and whether or not they experienced difficulty navigating familiar streets. Amongst a range of other measures, memory performance was assessed using the delayed recall component of the Telephone Interview for Cognitive Status (Brandt & Folstein, 2003). Amariglio et al. found that women complaining of one or more memory problems performed significantly worse than women who reported no problems with their memory. Furthermore, obvious decreases in delayed recall performance were observed with each additional memory complaint reported ($p < .001$). Despite these consistent decreases in performance with increasing memory complaints, however, the odds ratios reported by Amariglio et al. are still relatively small (mean $OR = 1.22$ across each additional complaint made).

In summary, despite some inconsistency with regard to significance testing for associations between memory complaints and memory performance, almost all studies report a weak association in the expected direction between them. Whilst significant relationships are reported slightly more frequently in studies using global assessments of memory complaints, this is likely attributable to differences in sample size, as effect sizes for the relationship between complaints and performance vary little according to whether questionnaires or global assessments are utilized. Some measures of memory performance may have stronger associations with some measures of complaint; though there is currently insufficient evidence to confidently argue this given the same measures of performance and complaints are rarely used across studies.

Memory Performance and Affective Distress

In addition to the relationship between memory complaints and memory performance, considerable effort has been expended on investigating the association between memory performance and affective distress. Whilst not a key focus of this thesis, the relationship between memory performance and affective distress is important here given it forms an important part of the complex interaction of variables associated with memory complaints. For this reason, the following section provides a brief summary of the more pertinent reviews examining the association between memory performance and two measures of affective distress that have been investigated extensively within the memory complaint literature; depression and anxiety. Unlike the association between memory complaints and memory performance, the relationship between memory performance and affective distress exhibits a more consistent relationship (particularly for depression). The literature on depression is reviewed first, followed by anxiety. Whilst one body of literature has examined the effect of anxiety on memory for specific material, such as threatening information (e.g., Mitte, 2008), here the focus is on how anxiety is associated with memory for neutral stimuli, given this is the paradigm used in the research reported in the latter section of this thesis.

Depression

Depression is one dimension of affective distress that appears to be related to memory performance. Reviews and meta-analyses examining the relationship between memory performance and depression provide considerable support for a relationship between them (Burt, Zembar, & Niederehe, 1995; Herrmann, Goodwin, & Ebmeier, 2007; McDermott & Ebmeier, 2009; Steffens & Potter, 2008). Herrmann et al., for example, reviewed studies observing neuropsychological test performance in depressed (late and early onset) and healthy older adults. Across six studies examining 13 measures of verbal and non-verbal memory, a mean Cohen's *d* value of .44 (ranging from .24 to .64) was obtained for comparisons between late-onset depression (i.e., depression diagnosed after 50 years of age) and healthy controls, whereby depression was associated with poorer performance. For comparisons of early onset depression and healthy controls, three studies reported a mean effect size

of .40 (ranging from .22 – .77). Performance differences between those with and without depression were also observed on measures of semantic memory (e.g., semantic fluency), though slightly smaller mean Cohen's *d* values were observed in these cases (.38 and .27 for late onset and early onset depression group differences from healthy controls, respectively).

In an earlier meta-analysis examining the association between depression and memory impairment, Burt et al. (1995) reported results outlining clear differences between depressed and non-depressed participants on various measures of memory. For 28 studies examining the association between depression status and recall, for example, Burt et al. reported a mean Cohen's *d* of .56, suggesting a robust effect of depression on memory performance in recall tasks. As part of the meta-analysis, Burt et al. also reported fail-safe statistics, which provide an indication of the relative stability of an effect by denoting the number of additional results with no effect required in order for the meta-analytic effect size to be small enough to fall above a specified alpha level. Such was the size of the effect of depression on recall performance for the studies reviewed that for it to decrease to a point where the alpha level exceeded .05, an additional 1103 studies with no effect of depression on recall would need to have been reported at that time (relative to just 28 that were included in the meta-analysis).

Evidently, there is a consistent relationship between depression and poor memory performance. Indeed, research over the past decade has shifted its focus from whether or not this relationship exists to understanding why it exists. Whilst a discussion of these explanations is beyond the scope of this chapter, research indicates a number of factors may play a role in the association, including the presence of distracting, mood-based cognitions (Ellwart, Rinck, & Becker, 2003; Jones, Siegle, Muelly, Haggerty, & Ghinassi, 2010; Levens, Muhtadie, & Gotlib, 2009), impaired motivation (Scheurich et al., 2008) and neurological conditions such as dementia that may mediate the relationship between them (Steffens & Potter, 2008).

Anxiety

Anxiety is implicated in a number of mental health disorders, including Social Phobia, Generalized Anxiety Disorder, Panic Disorder and Obsessive-Compulsive Disorder (American Psychiatric Association, 2013); the hallmark of which is the subjective experience of fear or worry causing above-normal levels of distress leading to impairment in functioning. The impact of this fear and worry on neuropsychological test performance has been the focus of much study (e.g., Airaksinen, Larsson, & Forsell, 2005; Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lonnqvist, 2008; MacLeod & Matthews, 2004). Whilst many studies have examined this relationship in clinical samples, studies have also examined sub-clinical anxiety as a predictor and outcome of memory performance (e.g., MacLeod & Donnellan, 1993; Sorg & Whitney, 1992).

Whilst not as robust as with depression, a number of reviews suggest anxiety can also be associated with poorer memory test performance (e.g., Beaudreau & O'Hara, 2008; Muller & Roberts, 2005; O'Toole & Pedersen, 2011). Based on a recent review of 30 papers and 698 adults with Social Anxiety Disorder, O'Toole and Pedersen concluded that social anxiety is not associated with universal cognitive impairment but that performance on some memory tasks tends to be poorer. For verbal memory, two studies (Airaksinen et al., 2005; Asmundson, Stein, Larsen, & Walker, 1994-1995) revealed significant decreases in performance in anxious participants relative to non-anxious participants, whilst a third study (Sachs, Anderer, Doby, Saletu, & Dantendorfer, 2003) found no difference. It should be noted, however, that small samples ($n = 25$) were used by Sachs et al. and that statistical power may have been an issue given the size of the effect reported in the two previous studies was relatively small. Despite some evidence for an association between anxiety and verbal memory, O'Toole and Pederson's review reported few other associations between memory performance and social anxiety.

An earlier review by Beaudreau and O'Hara (2008) examined the relationship between anxiety (both clinical and sub-clinical levels) and performance on a range of memory types, including memory for episodic information. For cross-sectional studies on episodic memory, Beaudreau and O'Hara reported that three

studies (Bierman, Comjls, Jonker, & Beekman, 2005; Booth, Schinka, Brown, Mortimer, & Borenstein, 2006; Mantella et al., 2007) found observable differences in memory performance according to levels of anxiety, whilst a fourth study (Derouesne, Rapin, & Lacomblez, 2004) did not. Mantella et al., for example, found impaired performance in participants who met diagnostic criteria for Generalized Anxiety Disorder (American Psychiatric Association, 2013) relative to healthy age- and education-matched controls across both the California Verbal Learning Test (CVLT; Delis et al., 1987) and memory component of the Dementia Rating Scale (Hughes, Berg, Danziger, Coben, & Martin, 1982). On the CVLT, anxious participants recalled fewer words for immediate recall, delayed recall and overall recall performance (Mantella et al., 2007). Again, statistical power may have played a role in the non-significant result reported by Derouesne et al., given the small number of anxious participants included in the study ($n = 18$).

In summary, there is evidence to suggest anxiety may be weakly associated with some measures of memory performance, both at clinical and sub-clinical levels. Reviews tend to suggest small deficits in memory for verbal and episodic information, though these deficits tend to be isolated to specific tasks rather than representing any universal cognitive impairment. As with depression, various explanations have been put forward to account for why anxiety appears to give rise to impaired memory performance (for reviews, see Beaudreau & O'Hara, 2008; Heinrichs & Hofmann, 2001). Whilst a discussion of these explanations is beyond the scope of this chapter, reasons for the association between anxiety and memory performance include a reduced capacity to attend to relevant information (Bogels & Mansell, 2004) as well as reduced working memory storage and processing capacity (Eysenck & Calvao, 1992).

Memory Complaints and Affective Distress

Whilst the association between memory complaints and objective memory performance is still being debated, consistently robust correlations between memory complaints and affective distress have lead researchers to suggest that older adults complaining of memory problems should perhaps be screened for underlying mental health issues as well (Comijs, Deeg, Dik, Twisk, & Jonker, 2002; Harwood et al.,

2004). A considerable number of studies have examined the relationship between memory complaints and affective distress. To ensure the review is relevant to this thesis, a similar set of inclusion criteria to those used earlier were utilized for literature in the following section (see Table 4). Akin to the section examining memory complaints and memory performance, studies examining the link between memory complaints and depression or anxiety needed to: (1) incorporate one or more measures of both memory complaints (not just cognitive complaints) and depression or anxiety, (2) report zero-order relationships between the complaint and depression and/or anxiety measures, (3) be cross-sectional and (4) incorporate a large proportion of older adults over 50 years of age. In order to maintain a focus on community-dwelling older adults but also obtain memory complaint data along the full spectrum of depression and anxiety severity, (5) studies with clinically depressed or anxious participants were included when they also incorporated a healthy older adult sample.

Table 4

Criteria for Studies Examining Memory Complaints and Affective Distress

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1. One or more measures of both memory complaints and depression / anxiety
 2. Zero-order relationship(s) for complaints and depression / anxiety measures
 3. Cross-sectional (i.e., not longitudinal) relationships
 4. Include a large proportion of older adults (e.g., adults over 50 years of age)
 5. At least partly a community sample, not entirely clinical
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Depression

A total of 18 studies examining the relationship between memory complaints and depression that met the criteria outlined in Table 4 were identified. Ten of these studies used questionnaire assessments of memory complaints, whilst eight utilized five or fewer questions to assess memory complaints more globally. As with memory complaints and memory performance, the following section reviews studies examining the link between memory complaints and depression separately for questionnaire assessments and global memory complaints.

Questionnaire assessments of memory complaints. The median sample size for the 10 studies examining the link between depression and memory complaints assessed via a questionnaire was 130, ranging from 50 up to 1204 participants. One of the 10 studies included more than one measure of depression and all studies included one questionnaire to assess memory complaints, with the exception of Derouesne et al. (1999), who included a global measure of memory complaint as well. The sample size and age range (or mean age), memory complaint measure, depression measure and whether or not an association was found for each of the 10 studies is provided in Table 5. All studies identified a significant association between memory complaints and depression.

Table 5

Questionnaire Studies on the Link between Memory Complaints and Depression

Study	N (age-years)	Complaint Measure	Depression Measure	Association (Yes / No)
Derouesne et al. (1999)	183 (50+)	SMS + 1	ZD	Yes
Dux et al. (2008)	130 ($M = 76.7$)	GFF	GDS	Yes
Kim et al. (2003)	1204 (65+)	GMS	GMS	Yes
Levy-Cushraan & Abeles (1998)	130 (47-90)	MAC-S	BDI / GDS	Yes
Minett et al. (2005)	60 (64-84)	MAC-Q	GDS	Yes
Potter & Hartman (2006)	99* (60-89)	GFF	GDS	Yes
Potter et al. (2009)	54* (62-89)	GFF	GDS	Yes
Slavin et al. (2010)	827 (70-90)	MAC-Q	GDS	Yes
Williams et al. (1987)	50 (40+)	MPQ	Diagnosis	Yes
Zeintl et al. (2006)	364 (65-80)	PRMQ	GDS	Yes

*All participants were female

Note: BDI = Beck Depression Inventory, DASS = Depression Anxiety Stress Scales, GDS = Geriatric Depression Scale, GFF = General Frequency of Forgetting Scale, GMS = Geriatric Mental State Schedule, MAC-Q = Memory Complaint Questionnaire, MAC-S = Memory Assessment Self-Rating Scale, MCS = Memory Complaints Scale, MPQ = Memory Problem Questionnaire, PRMQ = Prospective and Retrospective Memory Questionnaire, SMS = Subjective Memory Scale, ZD = Zung's Depression Self-Rating Scale.

The literature using questionnaires to evaluate memory complaints suggests that regardless of the measures used to assess memory complaints and depression, a significant association between the two has been found on each occasion. Seven studies utilized the Geriatric Depression Scale (Yesavage et al., 1982) as a measure of depression. Of these studies, all seven have reported that more severe depressive symptomatology is associated with more severe complaints of memory problems on the General Frequency of Forgetting (GFF) scale (Dux et al., 2008; Potter & Hartman, 2006; Potter et al., 2009), the Memory Assessment Self-Rating Scale (Levy-Cushraan & Abeles, 1998), the Memory Complaint Questionnaire (Minett et al., 2005; Slavin et al., 2010) and the Prospective and Retrospective Memory Questionnaire (Zeintl et al., 2006).

Potter and Hartman (2006), for example, reported a significant association between memory complaints and depression in 99 community-dwelling women over the age of 60 years. Using the GFF scale (Gilewski et al., 1990) and the Geriatric Depression Scale (Sheikh & Yesavage, 1986), Potter and Hartman reported a correlation of $-.47$ ($p < .01$), suggesting greater complaint severity was clearly associated with reports of higher levels of depression. A more recently published study by Potter, Hartman, and Ward (2009) reported the same strength relationship ($r = -.47$) between memory complaints and depression using the same measures in 54 community-dwelling women over the age of 60 years, though it is unclear whether or not this is a sub-sample of Potter and Hartman's earlier study.

A slightly larger study ($N = 130$) by Dux et al. (2008) also reported a significant, though slightly weaker, association between the Geriatric Depression Scale and the GFF scale in older adult males and females ($r = -.35$, $p < .001$). Given this result and those reported by Potter and colleagues (Potter & Hartman, 2006; Potter et al., 2009), a fairly consistent, medium- to large-sized association appears to exist between memory complaints and depression severity (when assessed via the Geriatric Depression Scale). However, these values may slightly over-estimate the relationship between memory complaints and depression given the Geriatric Depression Scale incorporates a question pertaining to memory problems.

An earlier study also examined the relationship between memory complaints and depression with the Geriatric Depression Scale (Levy-Cushraan & Abeles, 1998), though using the Memory Assessment Self-Rating Scale (Winterling et al., 1986) to measure complaints instead. Levy-Cushraan and Abeles reported a significant correlation between the two measures of $-.39$ ($p < .001$), again suggesting memory complaints were higher in those with greater depression symptomatology. Levy-Cushraan and Abeles also took a second measure of depression, the Beck Depression Inventory (Beck, 1987), for which they found an almost identical association with memory complaints on the Memory Assessment Self-Rating Scale ($r = -.38$, $p < .001$). Notably, the Beck Depression Inventory is one of the most widely-accepted measures of depression symptomatology and does not include questions pertaining to memory problems.

Two other more recent studies (Minett et al., 2005; Slavin et al., 2010) also examined the relationship between the Geriatric Depression Scale (Sheikh & Yesavage, 1986) and the Memory Complaint Questionnaire (Crook et al., 1992). In a small-scale study of 60 older adults between 64 and 84 years of age, Minett et al. reported a strong relationship between the measures ($\rho = .59$, $p < .001$). Indeed, of 14 measures compared with memory complaints in the study (including demographics, white matter lesions, Alzheimer's and mental state assessments, and various measures of memory), depression exhibited the strongest Spearman correlation coefficient by a considerable margin.

A more recent study by Slavin et al. (2010) found that participants exhibiting higher depressive symptomatology on the Geriatric Depression Scale also reported significantly more frequent and/or severe complaints of memory on the Memory Complaint Questionnaire (Crook et al., 1992). For 784 older adults between the ages of 70 and 90 years, Slavin et al. found a Pearson correlation of $.30$ between memory complaints and depression on these measures. In part, this relationship led Slavin et al. to argue that clinicians should keep in mind that memory complaints in older adults tend to correlate strongly with psychological factors (including depression) and therefore do not necessarily indicate the presence of any memory or cognitive impairment.

Another study by Zeintl et al. (2006) examining the association between memory complaints and scores on the Geriatric Depression Scale utilized the Prospective and Retrospective Memory Questionnaire (2000) as a measure of complaint. For 364 older adults aged between 65 and 80 years, Zeintl et al. reported a significantly higher number of depressive symptoms in the ‘high complainers’ group relative to the ‘low complainers’ group (which were differentiated on the basis of the median complaint score). The means and standard deviations reported in the article reflect a medium-sized effect (Cohen’s $d = 0.58$).

Derosne et al. (1999) examined the relationship between memory complaints and depression using the Subjective Memory Scale (Derouesne et al., 1989) and Zung’s Depression Self-Rating Scale (Zung, 1965). Using a sample of 183 older adults over the age of 50 years with clinically-diagnosed depression or cognitive impairment, Derosne et al. (1999) reported a significant difference in depression scale scores between participants with major and minor complaints (participants rated themselves as belonging to one of these two groups). As with, Zeintl et al. (2006), differences in memory complaint scores between the groups reflected a medium to large effect (Cohen’s $d = 0.72$). The results presented by Derosne et al. (1999) are noteworthy, given they suggest the association between memory complaints and depression does not simply reflect differences in healthy older adults and those with clinical levels of depression. Rather memory complaints differ in healthy older adults with varying degrees of pre-clinical depressive symptoms as well.

In a larger and more comprehensive study, Kim et al. (2003) also reported an association between memory complaints and depression. In a study incorporating 1204 older adults over the age of 65 years, both memory complaints and depression were assessed using questions from the Geriatric Mental State Schedule (Copeland, Dewey, & Griffith-Jones, 1986). Amongst a range of other variables, including demographics, physical illnesses, mental state and Apolipoprotein E status, depression was found to be the variable most strongly associated with memory complaints. Of the 1204 participants, 13% ($n = 152$) were classified as meeting criteria for depression. Of these 152 older adults, 41.4% were classified as memory

complainers compared to just 19.4% of participants not classified as meeting criteria for depression. Thus, participants who met criteria for depression were found to be more than twice as likely to complain of memory problems as those who did not meet criteria for depression.

One final study by Williams, Little, Scate and Blockman (1987) examining participants with ($n = 25$) and without ($n = 25$) depression found consistent differences between the groups across a range of memory complaint measures included in the Metamemory Questionnaire (Zelinski et al., 1980). Of 21 complaint measures (including memory for ‘things people tell you’, ‘items whilst shopping’ and ‘public speaking content’), 13 were found to differ significantly despite relatively low statistical power associated with the use of small samples. Cohen’s d effect sizes based on the means and standard deviations reported for the groups indicate that of the 21 comparisons, three reflect a small effect size, nine reflect a medium effect size and six reflect a large effect size.

Global assessments of memory complaints. The median sample size for the eight studies examining the link between depression and memory complaints measured via a global assessment of memory was 462.5, ranging from 114 up to 2546 participants. The number of questions used to gauge global complaints of memory ranged from one to five. A wide variety of depression measures were utilized. Three studies used the Geriatric Depression Scale, though Jungwirth et al. (2004) also used the Hamilton Depression Scale (Hamilton, 1960). The remaining measures of depression included Goldberg et al.’s (1988) depression scale, the Beck Depression Inventory (Beck, 1987), Cambridge Mental Disorders in the Elderly Examination (Roth et al., 1986) and the Center for Epidemiological Studies Depression Scale (Radloff, 1977). Tsai et al. (2006) did not use an established measure of depression but rather asked participants whether there had been a time in their past when they were unable to perform social and occupational functions as a result of depression. Regardless of how memory complaints and depression were assessed, all eight studies reported a significant association between them (Table 6).

Jungwirth et al. (2004), Jessen et al. (2007) and Minett et al. (2008) all reported significant associations between memory complaints and depression

measured via the Geriatric Depression Scale. Using a sample of 302 older adults aged 75 years, Jungwirth et al. assessed memory complaints using four questions about changes in functioning over the past two and a half years relating to past events, locating belongings, recalling conversations and remembering appointments and social events. Each question was scored as 0, 1 or 2 (indicating the degree of decline in memory functioning), providing a total score from 0 to 8. These scores were then correlated with scores on the Geriatric Depression Scale (Sheikh & Yesavage, 1986) and Hamilton Depression Scale (Hamilton, 1960). Jungwirth et al. reported significant associations in the expected direction with both depression measures, although Spearman correlations were relatively weak, ranging from .14 to .29.

Table 6

Global Assessment Studies Examining Memory Complaints and Depression

Study	N/n (age-years)	Complaint Questions	Depression Measure	Association
Jungwirth et al. (2004)	302 (75)	4	HAMD & GDS	Yes
Jorm et al. (2004)	2546 (60-64)	3	Goldberg Scale	Yes
Jessen et al. (2007)	2389 (75-89)	5	GDS	Yes
Lautenschlager et al. (2005)	227* (70+)	1	BDI	Yes
Minett et al. (2008)	114 (50+)	2	GDS	Yes
Riedel-Heller et al. (1999)	322 (75+)	2	CES-D	Yes
Tsai et al. (2006)	1499 ($M = 68.51$)	1	Self-Assessed	Yes
Zandi (2004)	603 (47-93)	4	CAMDEX	Yes

*All participants were female

Note: HAMD = Hamilton Depression Scale, GDS = Geriatric Depression Scale, BDI = Beck Depression Inventory, CAMDEX = Cambridge Mental Disorders in the Elderly Examination, CES-D = Center for Epidemiological Studies Depression Scale.

In a much larger study, Jessen et al. (2007) assessed 2389 older adults between the age of 75 and 89 years. Participants were grouped into three clusters on the basis of their pattern of memory complaints. The three clusters corresponded to

those with few general or specific complaints about memory problems (cluster 1), those with general complaints about memory functioning but few specific complaints (cluster 2) and those with general and specific complaints about memory functioning (cluster 3). Jessen et al. reported mean Geriatric Depression Scale scores of 1.73, 2.16 and 3.31 for each of these three clusters, respectively. These Geriatric Depression Scale scores were found to discriminate between the three clusters better than gender, age, apolipoprotein E4 status and scores of cognitive function assessed via verbal fluency and delayed recall.

In a smaller study, Minett et al. (2008) found depression severity assessed via the Geriatric Depression Scale to be a significant predictor of memory complaints. Subjective memory complaints were assessed via a yes or no response to the question, “Do you currently have any problems with your memory?” Of the 19 predictor variables included in the study (which included a number of neuropsychological assessments), Geriatric Depression Scale scores were one of only two predictors found to be significantly associated with the presence of complaints. An odds-ratio of 1.23 was reported for Geriatric Depression Scale scores, suggesting a relatively weak association despite the significant relationship.

Using Goldberg et al.’s (1988) rating scale for depression, Jorm et al. (2004) also reported an association with memory complaints assessed via three yes or no questions. A total of 2546 participants aged 60 to 64 years were asked, “Do you remember things as well as you used to?” Participants who responded affirmatively were then also asked whether their memory problem interfered with their day-to-day life and whether or not they had seen a doctor about it. Jorm et al. reported that scores on the depression measure indicated significantly greater depression severity in those who reported having memory problems versus those who did not ($OR = 2.16, p < .01$). Additionally, greater depression severity was also reported for participants with memory complaints who had seen a doctor versus those with memory complaints who had not ($OR = 1.91, p < .01$).

In another study of 227 women over the age of 70 years, Lautenschlager et al. (2005) examined the relationship between depression and memory complaints via the Beck Depression Inventory (Beck, 1987) and by asking participants whether they

“had any difficulty with their memory”. In addition, participants with an objective memory deficit were excluded by only including participants who could recall at least two of the three items on the MMSE (Folstein et al., 1975) delayed recall question. Consistent with the previous studies discussed, Lautenschlager et al. reported significantly greater depression severity in participants complaining of memory problems than participants who reported no problems with memory.

A further three relatively large-scale studies have also reported significant associations between memory complaints and symptoms of depression (Riedel-Heller et al., 1999; Tsai et al., 2006; Zandi, 2004). In the largest of these three studies, Tsai et al. asked 1490 older adults whether they “had trouble remembering things from one second to the next”. These responses were then compared with the participants’ perspectives on whether or not depression had interfered with their social and occupational functioning at any point in the past. Tsai et al. reported that 28 of the 134 (20.9%) participants who reported memory problems also reported a past history of depression; a much larger proportion than the 97 of 1356 (7.1%) participants who reported a past history of depression but no problems with their memory.

The remaining two studies (Riedel-Heller et al., 1999; Zandi, 2004) were smaller but used a more established, and arguably more valid, measure of depression. Riedel-Heller et al. assessed depression via the Center for Epidemiological Studies Depression Scale (Radloff, 1977) and memory complaints via two questions that resulted in four possible outcomes: (0) no problems, or problems occurring (1) seldomly, (2) often or (3) always. Data from 322 adults over the age of 75 years indicated a significant association between depression and memory complaints, whereby more complaints were associated with greater depression severity. Likewise, Zandi et al. also reported a significant association between complaints and depression. The Cambridge Mental Disorders in the Elderly Examination (CAMDEX, Roth et al., 1986) was used to assess depression and memory complaints were scored on a scale of one to four via four questions pertaining to general memory difficulties, losing objects, forgetting names and

getting lost. Regardless of objective memory performance, participants who reported more memory problems exhibited greater depression severity on the CAMDEX.

In summary, the relationship between memory complaints and depressive symptomatology is extremely consistent. All 18 studies that met criteria for inclusion in the previous section reported a significant association between complaints and depression. These results occurred regardless of how memory complaints and depression were assessed and with samples as small as 50 participants. Medium-sized effects for group comparisons (depression vs. no depression, whether clinical or sub-clinical) and correlations were typically reported, though small and large effect sizes were also occasionally found.

Anxiety

Anxiety is another psychological concept that has been investigated as a possible predictor of memory complaints. A total of nine studies meeting criteria outlined in Table 4 that have examined the relationship between memory complaints and anxiety were found. Five of these studies utilized established questionnaires as a measure of memory complaints, whilst the remaining four studies used four or fewer questions. A range of established psychometrically-validated anxiety measures were utilized across the studies. The following section reviews each of these nine studies and appraises the association between memory complaints and anxiety. As with the research on depression, the studies utilizing established questionnaires and global measures of memory complaints are reviewed separately.

Questionnaire assessments of memory complaints. The median sample size of the five studies utilizing questionnaires to assess memory complaints was 130, ranging from 54 up to 822 participants. For each of the studies, memory complaints were assessed via a single questionnaire with the exception of Derousne et al. (1999), who also utilized a global measure of complaint. Each of the studies also utilized a single established measure of anxiety. Details pertaining to each of the studies, as well as whether or not an association was found between memory complaints and anxiety, is reported in Table 7. Two of the five studies assessed anxiety via the Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988); the remaining three studies utilized Zung's Anxiety Self-Rating Scale (Zung, 1971), the

Anxiety Sensitivity Index (Reiss, Peterson, Gursky, & McNally, 1986) and Goldberg et al.'s anxiety scale (Goldberg et al., 1988). Consistent with literature examining the link between memory complaints and depression, anxiety was found to be significantly related to memory complaints in each of the studies also, regardless of the measures used.

Both studies examining the association between the GFF scale (Gilewski et al., 1990) and the Beck Anxiety Inventory (Beck et al., 1988) reported significantly higher levels of memory complaints in participants experiencing higher levels of anxiety (Potter & Hartman, 2006; Potter et al., 2009). In the earlier study, Potter and Hartman reported a zero-order Pearson correlation of $-.32$ ($p < .01$) between complaints and anxiety in 99 female older adults; an effect size approaching that reported for complaints and depression ($r = -.47$). In a more recently published study, Potter et al. reported a similar zero-order Pearson correlation of $-.29$ between the GFF scale and the Beck Anxiety Inventory. However, data for this study was drawn from the same data set used in the initial study.

Table 7

Questionnaire Studies Examining Memory Complaints and Anxiety

Study	N (age-years)	Complaint Measure	Anxiety Measure	Association (Yes / No)
Derouesne et al. (1999)	183 (50+)	SMS + 1	ZA	Yes
Dux et al. (2008)	130 ($M = 76.7$)	GFF	ASI	Yes
Potter & Hartman (2006)	99* (60-89)	GFF	BAI	Yes
Potter et al. (2009)	54* (62-89)	GFF	BAI	Yes
Slavin et al. (2010)	827 (70-90)	MAC-Q	GAS	Yes

*All participants were female

Note: ASI = Anxiety Sensitivity Index, BAI = Beck Anxiety Inventory, GAS = Goldberg Anxiety Scale, GFF = General Frequency of Forgetting Scale, MAC-Q = Memory Complaint Questionnaire, SMS = Subjective Memory Scale, ZA = Zung's Anxiety Self-Rating Scale.

A slightly larger and more recent study again reported a significant relationship between memory complaints and anxiety (Dux et al., 2008). In a study of 130 older adults, Dux et al. examined zero-order Pearson correlations between scores on the GFF scale and the Anxiety Sensitivity Index. Contrary to Potter and Hartman (2006), Dux et al. reported stronger associations with memory complaints for anxiety ($r = -.44, p < .001$) than for depression ($r = -.35, p < .001$). The stronger relationship between anxiety and memory complaints reported by Dux et al. relative to those values reported in the studies by Potter and colleagues (Potter & Hartman, 2006; Potter et al., 2009) may be attributable, at least in part, to skewed data on the Beck Anxiety Inventory (e.g., see Potter & Hartman, 2006, Table 1) or to gender, given Dux et al. also included males in their sample.

A slightly larger study undertaken by Derosne et al. (1999) also reported significant associations between memory complaints and anxiety. In 183 adults over the age of 50 years, Derosne et al. reported a moderate Pearson correlation of .333 ($p < .001$) between scores on the Subjective Memory Scale and on Zung's Anxiety Self-Rating Scale. Furthermore, the study reported significant differences in anxiety between participants who complained of 'major' problems with memory and those who complained of only 'minor' problems with their memory ($p < .001$). The correlation reported between memory complaints and anxiety by Derosne et al. was comparable to that reported for memory complaints and depression in the same study ($r = .327, p < .001$).

The largest and most recent study examining the relationship between anxiety and memory complaints assessed via a questionnaire, undertaken by Slavin et al. (2010), also reported a significant association between the two. In a study involving 827 older adults aged between 70 and 90 years, Slavin et al. reported a significant but weak zero-order Pearson correlation ($r = .185, p < .001$) between complaints assessed via the Memory Complaint Questionnaire and anxiety assessed via the Goldberg Anxiety Scale. In addition, participants with high levels of anxiety (> 4 on the Goldberg Anxiety Scale) reported more frequent and severe problems on the Memory Complaint Questionnaire than participants with low levels of anxiety (≤ 4

on the Goldberg Anxiety Scale). However, calculating an effect size for these groups suggests a relatively small difference between them (Cohen's $d = 0.39$, $p < .05$).

Global assessments of memory complaints. The median sample size of the four studies assessing memory complaints and anxiety without an established measure of anxiety was 264.5, ranging between 135 and 2546 participants. The number of questions used to assess memory complaints ranged from one to four, although one study (Clarnette, Almeida, Forstl, Paton, & Martins, 2001) confirmed memory complaints simply via presentation at a memory clinic. To assess anxiety, established measures of anxiety were utilized, including the Cambridge Mental Disorders in the Elderly Examination (Roth et al., 1986), Goldberg et al.'s anxiety scale (Goldberg et al., 1988), the State-Trait-Anxiety-Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and Beck's Anxiety Inventory (Beck et al., 1988). Consistent with studies examining the link between memory complaints and depression using global measures of memory complaints, all four studies examining the association between complaints and anxiety reported a significant association between them (see Table 8).

Table 8

Global Assessment Studies Examining Memory Complaints and Anxiety

Study	N/n (age-years)	Complaint Questions	Anxiety Measure	Association
Clarnette et al. (2001)	135 ($M = 62.5$)	-	CAMDEX	Yes
Jorm et al. (2004)	2546 (60-64)	1	GAS	Yes
Jungwirth et al. (2004)	302 (75)	4	STAI	Yes
Lautenschlager et al. (2005)	227* (70+)	1	BAI	Yes

*All participants were female

Note: BAI = Beck Anxiety Inventory, CAMDEX = Cambridge Mental Disorders in the Elderly Examination, GAS = Goldberg Anxiety Scale, STAI = State-Trait-Anxiety-Inventory.

Clarnette et al. (2001) reported significant differences between those complaining of memory complaints and healthy controls with regard to anxiety

measured via the Cambridge Mental Disorders in the Elderly Examination (Roth et al., 1986). Clarnette et al. interviewed 135 older adults, including 97 individuals who presented at a memory clinic with complaints of memory problems and 38 spouses used as healthy controls. Of those presenting with memory complaints, 66.0% reported symptoms of anxiety in contrast to just 44.7% of healthy controls. Despite the relatively small sample size, this difference was found to be significant ($p < .05$).

Similarly, Lautenschlager et al. (2005) also reported differences between those who did and did not complain of memory problems with regard to subjective experiences of anxiety. Of 227 female older adults over the age of 70 years, 121 participants responded affirmatively to, “Do you have any difficulty with your memory?” The remaining 106 participants were utilized as a healthy control group for comparison. Consistent with the results reported by Clarnette et al. (2001), Lautenschlager et al. reported considerable differences between the groups ($z = 4.17$, $p < .001$) for mean scores on the Beck Anxiety Inventory. Again, these results were comparable with the discrepancy between the groups for symptoms of depression.

Jungwirth et al. (2004) also reported significant associations between memory complaints and anxiety in a correlational design involving 302 adults aged 75 years. Participants were asked four questions regarding their possible memory problems pertaining to recent events, locating belongings, conversations and appointments. Each question was scored as 0, 1 or 2 on the basis of whether the participant felt he or she was similar (0), worse (1) or a lot worse (2) in these areas than 2.5 years ago (giving a total score ranging from 0 to 8). Spearman correlations were then reported for these scores with both state and trait measures of anxiety on the State-Trait-Anxiety-Inventory. Modest, yet significant correlations of .24 ($p < .01$) for trait anxiety and .23 ($p < .01$) for state anxiety were reported. In addition, Jungwirth et al. also utilized another global measure of complaint, “Do you have complaints about your memory in the last 2.5 years?” Comparable Spearman correlations of .19 ($p < .01$) and .19 ($p < .05$) were obtained for state and trait anxiety, respectively.

The largest of the four studies utilizing a global measure of complaint that has examined the relationship between memory complaints and anxiety (Jorm et al.,

2004) also found a significant difference in anxiety severity between the groups who did and did not complain of memory problems. In a study involving 2546 older adults aged between 60 and 64 years, Jorm et al. asked participants whether their memory functioned as well as it used to. Scores on the Goldberg Anxiety Scale were then contrasted for those who did and did not report a decline in memory function. A large effect size was reported for the difference between the groups ($d = 0.79$, $p < .001$), suggesting memory complaints are greater in those experiencing more frequent or severe symptoms of anxiety.

In summary, the literature also suggests the presence of a relationship between memory complaints and anxiety, albeit slightly more varied than that observed between memory complaints and depression. Each of the nine studies examining the relationship between memory complaints and anxiety reported a significant association between them, with effect sizes ranging from small through to large. These differences in reported effect sizes are possibly attributable to different measures of anxiety and memory complaints being used as well as sample differences (e.g., gender, recruitment method) and non-normal data distributions used in some studies.

CHAPTER 3

THE ROLE OF PERSONALITY

Key Points Addressed in Chapter Three

- Whilst earlier research has targeted affect (particularly aspects of depression and anxiety) as a predictor of memory complaints, studies have more recently begun to incorporate personality characteristics as possible predictors of complaints.
- Whilst theory makes clear predictions about how personality and affective distress interact when predicting memory complaints, little or no empirical research has targeted this issue.
- A number of studies report the presence of a relationship between aspects of personality and memory complaints; high levels of neuroticism and low levels of conscientiousness, for example, have been found to be consistently associated with more common or severe complaints of memory problems.
- Strong associations also exist between specific features of personality (particularly neuroticism) and both depression and anxiety.
- Whilst causal mechanisms for the relationship between personality and both depression and anxiety are still largely unknown, the literature provides several possible explanations via a number of different models and hypotheses.

CHAPTER 3: The Role of Personality

Prior to the last 10 years, research into memory complaints had focussed predominantly on examining neuropsychological test performance and affective distress as predictors. However, studies have more recently begun to demonstrate the importance of personality. Levels of neuroticism and conscientiousness, for example, have been found to be related to memory complaints (e.g., Pearman & Storandt, 2004, 2005). Whilst a number of studies have now identified the importance of various features of personality in memory complaints, the long-established relationship between personality characteristics and affective distress (reviewed later in this chapter) raises questions about the nature in which memory complaints and affective distress are related.

Theoretical accounts of memory complaints (reviewed in Chapter 4) outline a number of possible relationships amongst relevant predictor variables (e.g., Niederehe, 1998), though empirical studies into memory complaints have not yet adequately addressed these associations. The overlap between personality characteristics and affective distress, for example, has been largely overlooked in literature examining these variables as predictors of memory complaints. This is somewhat surprising given the importance of such relationships in understanding the direct and indirect associations with memory complaints. As justification for examining these relationships further, this chapter discusses empirical and theoretical literature examining the relationships that personality holds with both memory complaints and aspects of affective distress that are typically incorporated into memory complaint research (i.e., depression and anxiety).

Personality and Memory Complaints

To ensure the research is relevant to the study reported in the next section of this thesis, a set of criteria were utilized to select studies to be reviewed in this section. The criteria are listed in Table 9 and are similar to those used to select studies in the previous chapters. Firstly, studies needed to include at least one measure of memory complaints and one or more features of personality. Second, only studies providing a zero-order relationship between these variables were included (studies only providing adjusted or partial relationships were excluded).

Third, studies were only included when they examined concurrent relationships between these measures, given longitudinal relationships introduce a range of other possible influences (such as aging and fluctuations in mental health). Finally, given the current thesis focusses on community-dwelling older adults, only studies that incorporated a considerable proportion of older adults in their sample were included. That is, samples that included only clinical populations (e.g., those with a personality disorder diagnosis) were excluded.

Table 9

Criteria for Studies that Examine Personality and Memory Complaints

-
1. One or more measures of both personality and memory complaints
 2. Zero-order relationship(s) for personality and complaint measures
 3. Cross-sectional (i.e., not longitudinal) relationships
 4. Include a large proportion of older adults (e.g., adults over 50 years of age)
 5. At least partly a community sample, not entirely clinical
-

A total of seven studies examining the relationship between personality and memory complaints that met the criteria presented in Table 9 were found. The studies ranged in size from 57 through to 2546 participants, with a median sample size of 423 participants. Few studies used the same measures to assess personality characteristics or memory complaints; though six of the seven studies identified a significant relationship between at least one feature of personality and memory complaints. Measures used in the studies to assess characteristics of personality included the Minnesota Multiphasic Personality Inventory (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989), the Revised Eysenck Personality Questionnaire (Eysenck & Eysenck, 1991), the NEO Five-Factor Inventory (NEO-FFI, Scandell, 2000) and the NEO Personality Inventory (Costa & McCrae, 1992). Two studies used multiple measures to assess personality. To assess memory complaints, established measures included the Memory Assessment Clinic's Self-Rating Scale (Winterling et al., 1986), and the Memory Complaint Questionnaire

(Crook et al., 1992). Two studies utilized global measures of memory complaints (Comijs et al., 2002; Jorm et al., 2004), which were assessed using three or fewer questions. Another study used multiple established measures (Ponds & Jolles, 1996). The seven studies assessing the association between memory complaints and personality that met criteria in Table 9 are presented in Table 10.

Table 10

Studies Examining Personality and Memory Complaints

Study	N/n (age-years)	Personality Measure	Complaint Measure	Association
Comijs et al. (2002)	2032 (55-85)	Multiple	1 Q	Yes
Hanninen et al. (1994)	423 (67-78)	MMPI	MAC-Q	Yes
Jorm et al. (2004)	2546 (60-64)	EPQ-R	3 Qs	Yes
Pearman & Storandt (2004)	283 (45-94)	NEO-FFI	MAC-S	Yes
Pearman & Storandt (2005)	85 ($M = 73.2$)	NEO PI-R	MAC-S	Yes
Ponds and Jolles (1996)	57 ($M = 63.1$)	Multiple	Multiple	No
Slavin et al. (2010)	827 (70-90)	NEO-FFI	MAC-Q	Yes

Note: EPQ-R = Eysenck Personality Questionnaire – Revised, MAC-Q = Memory Complaint Questionnaire, MAC-S = Memory Assessment Clinic’s Self-Rating Scale, MMPI = Minnesota Multiphasic Personality Inventory, NEO-FFI = NEO Five-Factor Inventory, NEO PI-R = Revised NEO Personality Inventory.

A cross-sectional study by Hanninen et al. (1994) incorporating a total of 423 older adults between the age of 67 and 78 years was one of the earliest to examine the relationship between memory complaints and features of personality. Hanninen et al. used measures to examine whether affective states (the Geriatric Depression Scale, Sheikh & Yesavage, 1986), features of personality (Minnesota Multiphasic Personality Inventory, Butcher et al., 1989) or objective measures of memory, including Benton’s Visual Retention Test (Benton, 1974) and the Paired-Associated Learning Test from the Wechsler Memory Scale (WMS, Wechsler, 1987), differed in those with and without subjective memory complaints. Hanninen et al. reported that

personality traits, and not memory performance, was associated with complaints, finding that memory complaints were associated with low confidence in one's own abilities.

Perhaps the most prominent research published on the relationship between personality and memory complaints were two studies undertaken by Pearman and Storandt (2004, 2005). In their initial study, Pearman and Storandt examined a number of possible predictors of memory complaints in 283 community-dwelling adults aged between 45 and 94 years. Included in these predictors were the personality traits that make up the Five-Factor Model of Personality (McCrae & Costa, 1987; McCrae & Oliver, 1992). Of those five traits, memory complaints were found to be related to both neuroticism and conscientiousness (assessed via the NEO-FFI, Costa & McCrae, 1992). Neuroticism ($r = -.42$) and conscientiousness ($r = .46$) were found to be better predictors of memory complaints than LM performance (Wechsler, 1997), scores on the Geriatric Depression Scale (Sheikh & Yesavage, 1986), scores on the Anxiety About Aging scale (Lasher & Faulkender, 1993) and a general health rating.

Consequently, Pearman and Storandt (2005) further examined personality traits as predictors of subjective memory complaints in a smaller sample of 85 community-dwelling older adults via telephone. This study utilised the more detailed personality inventory, the NEO Personality Inventory (Costa & McCrae, 1992), to measure overall trait scores (for neuroticism and conscientiousness) as well as specific facets of these measures (e.g., self-consciousness, impulsiveness and vulnerability). In addition to personality, Pearman and Storandt again took measures of self-esteem (Crook & Larrabee, 1992) and objective memory performance, including the LM subtest (Wechsler, 1987) and prospective memory tasks (e.g., asking participants to call the researchers when they received a pack in the mail). Correlations suggested that personality traits as well as some specific features of them were related to memory complaints, including neuroticism ($r = -.36$), conscientiousness ($r = .40$), self-discipline (a facet of conscientiousness, $r = .40$) and self-consciousness (a facet of neuroticism, $r = -.45$). In addition, self-esteem was again found to correlate with memory complaints ($r = .35$). Thus, Pearman and

Storandt proposed that treatments for older adults complaining of memory problems should target self-discipline and self-concept.

In an earlier, much larger study, Jorm et al. (2004) assessed 2546 adults between 60 and 64 years of age. The study assessed older adults on a range of measures, including demographics, cognitive functioning, psychiatric state, personality, physical health measures and number of visits to a general practitioner in those who did and did not present with global memory complaints. Complainers and non-complainers differed significantly on several of the measures (partly due to high statistical power on account of the large sample size), including demographics, cognitive function, psychiatric state, physical health and visits to a general practitioner. In addition, those who reported memory complaints exhibited higher levels of neuroticism, ruminative behaviour (a measure of one's inclination to focus on negative emotions) and behavioural inhibition (a measure of how responsive someone is to punishment). Furthermore, those who reported complaints about their memory also exhibited lower levels of extraversion and mastery (a measure of whether one feels in control of their life) than those not complaining of memory problems. Across the personality measures, ruminative behaviour and neuroticism were found to be most strongly associated with memory complaints.

Slavin et al. (2010) focussed on an older sample of 827 participants aged between 70 and 90 years and found comparable results. Among a range of other cognitive abilities and measures of affective distress, the study assessed whether memory complaints (Memory Complaint Questionnaire, Crook et al., 1992) were associated with measures of neuroticism, openness and conscientiousness (NEO-FFI, Costa & McCrae, 1992). Whilst sub-groups representing different degrees of memory impairment did not exhibit different degrees of memory complaints, complaints were found to be associated with higher neuroticism scores and lower conscientiousness scores.

A smaller study undertaken by Ponds and Jolles (1996) incorporating 102 older adults (50 presenting with memory complaints and 52 matched controls) again reiterated the importance of neuroticism in memory complaints. Ponds and Jolles reported in their paper that neuroticism scores, whilst considerably different between

the groups, did not differ significantly ($p = .054$) in those who did and did not complain of memory problems. However, the neuroticism measure was added to the study in a later phase and only administered to 28 memory complainers and 29 controls. When a Cohen's d value is calculated for their results, based on the means and standard deviations presented, it suggests a medium-strength relationship between memory complaints and neuroticism (Cohen's $d = 0.52$); a similar strength relationship to that of memory complaints and depression (Cohen's $d = 0.48$).

Another large-scale study (Comijs et al., 2002) that followed 2032 participants over a six-year period also provided very strong evidence for the importance of personality (particularly neuroticism) in memory complaints. Comijs et al. assessed mastery (via the Pearlin Mastery Scale, Pearlin & Schooler, 1978), perceived self-efficacy (via the General Self-Efficacy Scale, Bosscher & Smit, 1998) and neuroticism (via the Dutch Personality Questionnaire, Luteijin, Starren, & van Dijk, 1985) as predictors of whether or not one has complaints about their memory. Odds ratios indicated that participants exhibiting high levels of neuroticism were almost twice as likely ($OR = 1.81$) to complain of memory problems than those exhibiting low levels of neuroticism. Similarly, low self-efficacy ($OR = 1.39$) and low mastery ($OR = 1.56$) were also predictive of participants complaining about memory.

In summary, scientific literature strongly suggests that aspects of personality (particularly measures of neuroticism) are associated with memory complaints in community-dwelling older adults. In some cases these measures exceeded the predictive value of better-documented predictors, such as measures of depression and anxiety. Effect sizes for various measures of personality were typically found to be medium in size. In particular, measures of neuroticism were found to be consistently associated with measures of memory complaints, suggesting complaints may primarily be driven by worry or features associated with it. Conscientiousness appears to be another feature of personality (negatively) associated with complaints, suggesting more conscientious individuals tend to complain of fewer or less severe problems with memory.

Personality and Affective Distress

Depression

The relationship between characteristics of personality and the onset, maintenance and course of depression has been of great research interest over a sustained period of time (Akiskal, Hirschfeld, & Yerevanian, 1983; Bagby et al., 2008; Brown, Svrakic, Przybeck, & Cloninger, 1992; Klein et al., 2011; Klein, Wonderlich, & Shea, 1993). Research has consistently indicated that a relationship exists between aspects of personality (particularly neuroticism) and depression (e.g., Barnhofer & Chittka, 2010; Farmer, Redman, Harris, Mahmood, & Sadler, 2002; Hettema, Neale, Myers, Prescott, & Kendler, 2006; Roberts & Kendler, 1999; Weber et al., 2011). For example, a study of 79 depressed outpatients and 102 healthy controls by Weber et al. recently reported that neuroticism (assessed via the NEO-Personality Inventory, Costa & McCrae, 1992) uniquely accounted for 25% of the variance in depression status (i.e., depressed or not depressed), even after age, education, scores measuring physical disease (assessed via the Clinical Illness Rating Scale, Conwell, Forbes, Cox, & Caine, 1993) and extent of home care required (hours per week) were already accounted for.

Given the large number of studies identifying relationships between aspects of personality and depression, more recent research efforts have attempted to explain why (rather than whether) the two concepts are related. Despite the robustness of the relationships between aspects of personality and depression, considerable debate continues with regard to the causal mechanisms that underpin them and whether or not one is an outcome of the other (Klein et al., 2011). For this reason, and for the sake of conciseness and relevance to the current study, the following section discusses a range of models that attempt to explain the relationship between personality and depression as well as a selection of key empirical studies that have assessed them.

A recently-published review (Klein et al., 2011) summarises various types of models depicting possible relationships between personality and depression. Klein et al. identified seven types of models that can effectively be grouped into one of three categories. The first category includes three models that propose personality and

depression do not causally influence each other but rather share a common underlying cause that influences both. Included in this category are the common-cause, continuum/spectrum, and precursor models. The second category describes a group of models that propose depression is an outcome of personality. Included in this category are the predisposition and pathoplasticity models. A third category proposes, contrary to the second category, that personality is an outcome of depression. The concomitants and consequence/scars models make up this third category.

Common-cause, continuum/spectrum and precursor models. According to Klein et al. (2011), the common-cause model proposes that the association between personality and depression exists not because one factor influences the other but because both are the result of the same or a very similar set of etiological factors. In the case of neuroticism and depression, for example, such factors might include genetic vulnerabilities or learned behaviours that predispose an individual to negative thinking. Such factors could increase the likelihood of higher levels of neuroticism and features of depression without necessarily implying a direct connection between them. The continuum/spectrum model also implies that personality characteristics and depression share a common etiology; however, this model proposes that the two concepts are not separate entities but rather part of the same spectrum. For example, individuals differ in terms of depressive personality traits, and the continuum/spectrum model proposes that clinical levels of depression simply reflect greater severity or a higher number of these traits – not because they increase the risk of depression but because they are in fact just different approximations (i.e., on-going and current) of the same underlying concept. The precursor model also implies that both personality characteristics and depression are outcomes of common etiological factors; however, it also assumes that depression is an end product to escalated levels of a particular set of traits. The model does not assume that personality characteristics cause depression but rather asserts that the presence or absence of depression typically follows them.

Support in the literature exists for both the common cause and continuum/spectrum models (Klein, 1999; Klein & Miller, 1993; Orstavik, Kendler,

Czajkowski, Tambs, & Reichborn-Kjennerud, 2007) as well as for the precursor model (Kwon et al., 2000). Orstavik et al., for example, examined genetic and environmental risk factors for Depressive Personality Disorder and Major Depressive Disorder in a study of 1777 female and 1024 male twins. The results of the study indicated that genes accounted for a considerable amount of the shared variance between each diagnosis (approximately 48%, the remaining 52% was attributed to environmental factors). Whilst additional genetic contributions existed for Major Depressive Disorder that were not associated with Depressive Personality Disorder, the research still suggests considerable overlap in the genetic predispositions to these two diagnoses, providing support for models based on the premise that the relationship exists on account of shared etiology (i.e., the common cause, continuum/spectrum and precursor models).

Contrary to the continuum/spectrum model, however, literature also suggests that personality characteristics relevant to depression and depression itself may in fact represent separate entities, despite their considerable overlap (Klein, 1990; Klein & Miller, 1993). Klein and Miller, for example, examined current and life-time psychiatric diagnoses (according to DSM-III criteria, American Psychiatric Association, 1987) in college students who did ($n = 36$) and did not ($n = 149$) meet Akiskal's (1983) criteria for Depressive Personality Disorder. Klein and Miller reported significantly greater rates of current and lifetime mood disorders in the depressive personality group, including Major Depressive Disorder and Dysthymia. Despite this association, almost 40% of individuals who met criteria for depressive personality at the time of the study had never met DSM-III criteria for a mood disorder. Such data suggests a considerable, but not complete, overlap between depressive personality traits and depression, thus challenging the notion put forward by the continuum/spectrum model that the two concepts represent different degrees of severity of the same underlying phenomenon.

Further evidence exists for the precursor model (Kwon et al., 2000), which suggests that a diagnosis of Depressive Personality Disorder may precede an increased risk of a Dysthymia diagnosis (a less severe, more chronic mood disorder than Major Depressive Disorder, outlined in the DSM-5, American Psychiatric

Association, 2013). In a study incorporating 72 women diagnosed with Depressive Personality Disorder (with no other comorbid axis I or axis II disorder, American Psychiatric Association, 1994) and 75 healthy, age-matched controls, Kwon et al. examined rates of Dysthymia and Major Depressive Disorder at baseline and 3-year follow-up. The results indicated that the group diagnosed with Depressive Personality Disorder at baseline exhibited significantly higher scores on the Beck Depression Inventory (Beck, 1987) at follow-up relative to baseline (though no significant difference was observed for the control group) and significantly increased risk of Dysthymia. Together with previous research suggesting personality and depression share etiological processes to a considerable degree (Klein, 1999; Klein & Miller, 1993; Orstavik et al., 2007), Kwon et al.'s study provides support for the precursor model, indicating that underlying processes may contribute to both personality and depression but that changes in personality may still precede a diagnosis of a mood disorder.

Predisposition and pathoplasticity models. As indicated, the second category of models speculating on the relationship between personality characteristics and depression specify that changes in personality do not just precede depression (as in the precursor model); rather they instigate it. The first of the two models in this category, the predisposition model, asserts that personality characteristics contribute to one's risk of depression (Klein et al., 2011). Like the precursor model, the predisposition model suggests that personality characteristics precede the onset of depression; however, in contrast to the precursor model, depression need not share any etiological features with characteristics of personality. The model signifies a chronological process between personality and depression, whereby genes and environment contribute to personality, which in turn contributes (in combination with genes and environment) to depression vulnerability. Furthermore, the predisposition model suggests that the relationship between personality and depression is mediated and/or moderated by environmental variables, such as increased stress or negative life experiences (e.g., dysfunctional relationships).

Whilst Kwon et al.'s (2000) longitudinal data does not necessarily imply a causal relationship between personality characteristics and depression, it does support the predisposition model to some degree, since the results indicate personality differences precede changes in depression symptomatology and closely related mood disorders. Recent research by Rudolph and Klein (2009) also observed a relationship between traits of Depressive Personality Disorder and symptoms of depression at 12-month follow-up. As part of a study of 143 young people, Rudolph and Klein examined the developmental consequences of depressive personality traits (assessed via a 16-item inventory, Klein, 1990). Depressive personality traits at baseline were found to be a significant predictor of depressive disorders at follow-up (assessed via the Schedule of Affective Disorders and Schizophrenia for School-Age Children - Epidemiologic Version, Orvaschel, 1995), even after variance associated with baseline depressive disorders (e.g., Major Depressive Disorder and Dysthymia) and non-depressive disorders (e.g., anxiety) was partialled out. Furthermore, the results suggested that the relationship between depressive personality traits and depression severity was mediated by increased familial stress. Such a result provides relatively strong support for the predisposition model, which predicts that personality influences depression via mediating variables.

The second model proposing a causal influence from personality to depression, the pathoplasticity model, differs from the predisposition model in that it proposes personality influences the expression of depression (or associated symptoms), rather than impacting directly on depression itself. Thus, personality is said to contribute not to the onset of depression but to its presentation, severity, chronicity and response to treatment. The pathoplasticity model implies that traits of neuroticism and depressive personality, for example, do not directly contribute to depression. Rather they may expose particular symptoms (e.g., displays of suicidal ideation initiated through higher levels of pessimism), increase severity (e.g., increased feelings of worthlessness through more frequent self-criticism), help to maintain a depressive episode (e.g., via ongoing feelings of guilt or remorse) or limit treatment efficacy (e.g., via feelings of inadequacy).

The pathoplasticity model is also supported by the results of Kwon et al.'s (2000) longitudinal study. Indeed, one could argue that the increased risk of Dysthymia and increased scores on the Beck Depression Inventory at 3-year follow-up are associated with baseline depressive personality traits not because personality factors instigate depression but because they increase the likelihood of it being detected. Furthermore, evidence also exists suggesting that depressive personality is associated with poorer outcomes for some treatments in individuals diagnosed with Major Depressive Disorder (Ryder, Quilty, Vachon, & Bagby, 2010). In a randomized control trial of 120 individuals with major depression, Ryder et al. examined treatment outcomes for interpersonal therapy (Weissman, Markowitz, & Klerman, 2000), cognitive behavioural therapy (Greenberger & Padesky, 1995) and antidepressant medication (administered according to Kennedy, Lam, Cohen, Ravindran, & CANMAT Depression Work Group, 2001) across those with and without traits of Depressive Personality Disorder. Whilst traits of Depressive Personality Disorder did not impact on outcomes for cognitive behavioural therapy and antidepressant medication, Ryder et al. observed poorer treatment outcomes for interpersonal therapy in those with more symptoms of Depressive Personality Disorder. Thus, as predicted by the pathoplasticity model, characteristics of Depressive Personality Disorder may be associated on some level with treatment outcomes in major depression.

Concomitants and consequences/scars models. The final category of models attempting to explain the nature of the relationship between personality characteristics and depression are the concomitants and consequences/scars models. In contrast to the predisposition and pathoplasticity models, these models assert that the relationship exists not because personality influences depression but because depression influences personality. The concomitants model, for example, proposes that evaluations of personality are shaped by the presence of depression, thus influencing its presentation. For example, neuroticism and depressive personality traits are presumed to be relatively consistent during periods of reasonable mental health; however, the appearance of these characteristics changes considerably during periods of poor mental health, whereby such characteristics are amplified. Furthermore, the concomitants model proposes that this change in the appearance of

personality during periods of poor mental health is temporary and that personality returns to a stable baseline upon re-establishing a reasonable level of mental health.

There is support for the concomitants model within the literature as well. For example, several studies have observed distinct personality profiles in those with and without a diagnosis of depression (e.g., Bagby & Ryder, 2000; Cox, McWilliams, Enns, & Clara, 2004; Enns & Cox, 1997). Perhaps more importantly, however, there is also evidence that some aspects of personality change with remission of a depressive episode (Bagby, Joffe, Parker, Kalembo, & Harkness, 1995; Fava et al., 2002).

Bagby et al. (1995) examined changes in characteristics of neuroticism, extraversion, openness, agreeableness and conscientiousness (assessed via the NEO-Personality Inventory, Costa & McCrae, 1992) in 57 outpatients diagnosed with Major Depressive Disorder over a three-month period. Correlations indicated that baseline depression severity, assessed using the Beck Depression Inventory (Beck, 1987) and Hamilton Rating Scale for Depression (Hamilton, 1967), was most consistently associated with neuroticism scores. However, neuroticism scores were significantly lower and extraversion scores significantly higher in individuals who no longer met depression criteria relative to those who did meet criteria at 3-month follow-up. Thus, changes in personality accompanied remission of the depressive episode, consistent with the notion that depression impacts on the assessment of personality characteristics (see also De Fruyt, Van Leeuwen, Bagby, Rolland, & Rouillon, 2006). However, even over such short periods with this design, one cannot rule out the possibility that changes in neuroticism influenced depression status (as suggested by the predisposition and pathoplasticity models) or, indeed, that a third underlying variable is responsible for changes in both (as suggested by the common cause, continuum/spectrum and precursor models).

Klein (1990) provided some evidence against the concomitants model, suggesting that the assessment of Depressive Personality Disorder traits using a semi-structured interview is not influenced by whether or not the individual is experiencing a Major Depressive Episode at the time of the assessment. The study examined Depressive Personality Disorder traits in outpatients at baseline and 6-

month follow-up. To examine the effect of depression on depressive personality traits, Klein compared the number of depressive personality traits at baseline and follow-up in outpatients ($n = 25$) who met a diagnosis for a mood disorder at baseline but who reported no more than two mild depressive symptoms at follow-up (and thus no longer met criteria for Major Depressive Disorder). No significant difference in the number of Depressive Personality Disorder traits was found between these time points, suggesting depressive personality characteristics are independent of mood disorder status. However, these results are inconsistent with those reported by Bagby et al. (1995), which may be partly attributable to the manner in which personality disorder traits were assessed (i.e., questionnaire assessment vs. interview).

The consequences/scars model, like the concomitants model, also suggests that depression impacts on personality. However, while the concomitants model proposes personality is simply distorted by depression, the consequences/scars model argues that personality is in fact altered by it. Thus, personality is presumed to be altered over the course of the depressive episode and this change is presumed to be long-lasting, if not permanent. Research provides strong support that major depression is directly associated with concurrently elevated levels of self-criticism (Cox et al., 2004). The concomitants model suggests this is simply because depressive symptoms alter the presentation patterns of self-criticism. However, the consequences/scars model proposes that such changes in self-criticism should remain long after remission of the depressive episode. Evidence on whether enduring personality changes result from depression is mixed, with some studies observing long-term changes to personality (Fanous, Neale, Aggen, & Kendler, 2007; Kendler, Neale, Kessler, Heath, & Eaves, 1993) and others observing no lasting change (Ormel, Oldehinkel, & Vollebergh, 2004; Shea et al., 1996).

Fanous et al. (2007) examined the nature of causal relationships between Major Depressive Disorder and characteristics of personality (neuroticism and extraversion) in a large-scale population based study of 3030 male twins. Controlling for levels of neuroticism at baseline, Fanous et al. found Major Depressive Disorder was still a significant predictor of neuroticism at follow-up. Such a result is

consistent with the consequences/scar model and suggests Major Depressive Disorder may be related to future levels of neuroticism irrespective of neuroticism levels at baseline. In addition, neuroticism levels at baseline were also indirectly predictive of Major Depressive Disorder status at follow-up (via a range of genetic and environmental factors), providing further support for the predisposition models.

An earlier study (Shea et al., 1996) of 94 depressed (first episode) and 708 non-depressed individuals, however, reported that personality characteristics were not altered or ‘scarred’ by major depression. In a 6-year follow-up study, Shea et al. examined baseline and follow-up levels of neuroticism, extraversion, emotional reliance, social self-confidence, sociability, ascendance/dominance, general activity, restraint, thoughtfulness and hysteria in individuals with no history of affective disorders that did and did not meet diagnostic criteria for Major Depressive Disorder during the 6-year interval. Whilst an effect of depression was observed on measures of neuroticism, emotional reliance and thoughtfulness, no depression by time interactions were significant for any of the personality measures, suggesting a diagnosis of depression was not associated with changes in any of the personality measures. Klein et al. (2011) suggest the discrepancy between these results and those obtained by Fanous et al. (2007) may be attributable to a shorter follow-up or less stringent remission criteria. In addition, this difference might also be due to sample differences, whereby ‘scarring’ is more likely to be observed in individuals with a prior history of depression (who were excluded in Shea et al.’s study).

In summary, whilst personality is unquestionably associated with depression, considerable debate continues regarding the causal mechanisms that instigate this relationship. Several models argue specific personality characteristics increase the risk of subsequent depression, others suggest personality is distorted or shaped by depression, whilst yet another group of models propose the two are not directly related at all but rather outcomes of the same or a similar set of etiological factors. There is empirical support for each of these approaches, suggesting no one particular model may be entirely sufficient to fully explicate the relationship between depression and characteristics of personality. Indeed, it may be the case that personality and depression are linked through a complex combination of specific

etiological processes as well as both direct and indirect reciprocal influences on each other.

Anxiety

As with personality characteristics and depression, considerable evidence exists demonstrating a clear pattern of association between personality and anxiety (Bienvenu, 2007; Kotov et al., 2010; Kotov et al., 2007; Kristensen, Mortensen, & Mors, 2009; Matsudaira & Kitamura, 2006; Middeldorp et al., 2006). Indeed, a recent and comprehensive meta-analytic review of almost 30 years of literature (Kotov et al., 2010) indicated a very strong positive association between several anxiety disorders (i.e., Generalized Anxiety Disorder, Posttraumatic Stress Disorder, Panic Disorder, Agoraphobia, Social Phobia, Specific Phobia and Obsessive-Compulsive Disorder) and neuroticism (mean Cohen's $d = 1.77$). Strong negative associations were also generally observed between anxiety and conscientiousness (mean Cohen's $d = -0.97$) as well as anxiety and extraversion (mean Cohen's $d = -0.93$).

Whilst there is clear support for an association with neuroticism across most, if not all, anxiety disorders, the association with other aspects of personality (particularly extraversion) is somewhat more complicated. For example, research generally suggests that across disorders, extraversion still accounts for a significant amount of variance in anxiety in addition to that already explained by neuroticism (Kotov et al., 2010; Middeldorp et al., 2006). Extraversion exhibits a mean effect size indicative of a strong association with anxiety disorders overall (Kotov et al., 2010), though Cohen's d values varied considerably between particular disorders and are estimated to be as low as .20 for Specific Phobia and as high as 1.31 for Social Phobia. Thus, the circumstances that trigger the anxiety are likely a key determinant in the extent to which characteristics of personality are involved.

Despite these intricacies, recent research has at the same time also focussed on the manner in which anxiety and personality are causally related. As with depression, a number of explanations have been put forward to account for the relationship between anxiety and characteristics of personality (Andersen & Bienvenu, 2011; Brandes & Bienvenu, 2006). Perhaps not surprisingly, given the

conceptual and structural overlap between depression and anxiety (e.g., Clark & Watson, 1991), these relationships can be considered within a similar framework to the relationship between personality and depression. Whilst a recent review by Anderson and Bienvenu (2011) proposed four basic models detailing the relationship between anxiety and personality characteristics, the framework is effectively a summarised version of the seven models proposed for depression by Klein et al. (2011). The four models include (1) the vulnerability hypothesis, (2) the scar hypothesis, (3) the pathoplasty hypothesis and (4) the common cause/spectrum hypothesis.

The vulnerability hypothesis. The vulnerability hypothesis proposes that one or more characteristics of personality predispose an individual to an increased risk of affective distress and psychiatric conditions (Andersen & Bienvenu, 2011). In the context of depression, this hypothesis is referred to by Klein et al. (2011) as the predisposition model. With regard to anxiety, for example, Andersen and Bienvenu suggest that lower levels of extraversion may precede the development of social phobia given it is associated with less frequent and less vigorous attempts to seek out social interaction. Presumably such a relationship would at least, in part, be mediated by a process of habituation, whereby decreases in subjective and objective measures of anxiety are observed with continued exposure to anxiety-provoking situations (Mauss, Wilhelm, & Gross, 2003). Considerable empirical support has been provided for the vulnerability hypothesis in the context of personality and anxiety (e.g., Bienvenu et al., 2009; Bramsen, Dirkzwager, & van der Ploeg, 2000; Johnson et al., 1999; Krueger, 1999).

Results from longitudinal research support the notion that certain personality characteristics precede increased levels of anxiety (Krueger, 1999). In a study of 961 participants from the Dunedin Multidisciplinary Health and Development Study, Krueger examined how well personality traits (assessed via the Multidimensional Personality Questionnaire, Tellegen, 1982) at age 18 predicted anxiety disorders (assessed via the Diagnostic Interview Schedule, Robins, Helzer, Cottler, & Goldring, 1989) and anxiety severity (assessed by summing scores on the Diagnostic Interview Schedule) at age 21. In the prediction of affective disorders at age 21, two

of four broad factor scales assessing personality were significant predictors of anxiety disorder status beyond disorder status at age 18. Negative Emotionality (a trait conceptually similar to neuroticism) and Constraint (a trait conceptually related to Openness to Experience and Extraversion, Costa & McCrae, 1992) returned odds ratios of 1.63 and 1.31, respectively. At a more detailed level, two subscales (out of 10) significantly predicted anxiety disorder status at age 21 beyond disorder status at age 18; Stress Reaction and Alienation (both subscales from the Negative Emotionality scale), which returned odds ratios of 1.43 and 1.38, respectively. When examining severity rather than disorder status, anxiety was significantly predicted by the Negative Emotionality scale as well as the Stress Reaction and Harm Avoidance subscales. Thus, the results provided by Krueger strongly suggest specific personality characteristics play a role in predicting future anxiety disorder status and anxiety severity beyond baseline anxiety disorder status. Furthermore, these characteristics are largely reflective of a tendency to experience negative emotions.

In a more recently published longitudinal study assessing the relationship between personality disorder traits and subsequent development of psychiatric conditions, Bienvenu et al. (2009) reported that specific personality traits precede Panic Disorder and Agoraphobia. In a sample of 432 adults, the study reported that traits of avoidance and dependence at baseline predicted the onset of both Panic Disorder and Agoraphobia at 12- to 15-year follow-up. Furthermore, this relationship was maintained even when baseline symptoms of panic were taken into account. Based on the data, Bienvenu et al. propose that personality characteristics are not simply associated with such psychiatric conditions but rather precede them, possibly acting as a predisposing factor.

The scar hypothesis. In contrast to the Vulnerability hypothesis, the Scar hypothesis suggests that the association between personality and affective distress is attributable to the impact of affective distress on personality (Andersen & Bienvenu, 2011; Klein et al., 2011). That is, rather than characteristics of personality increasing the risk of anxiety, changes in personality are said to result partly from experiences of above-normal levels of anxiety. Whilst there is considerably fewer studies examining the chronological impact of anxiety on personality than personality on

anxiety, there is still good evidence that anxiety precedes certain dysfunctional personality characteristics (Kasen, Cohen, Skodol, Johnson, & Brook, 1999; Kasen et al., 2001).

Kasen et al. (1999), for example, examined the association between psychiatric disorders in childhood and personality disorders in adulthood in a longitudinal study of 551 individuals over a 9-year period. The study reported that the presence of an anxiety disorder at baseline predicted both cluster A (Paranoid, Schizoid and Schizotypal) and cluster C (Avoidant, Dependent, Obsessive-Compulsive) personality disorders at follow-up. However, baseline anxiety disorders were found not to be associated with an increased risk of cluster B (Antisocial, Borderline, Histrionic and Narcissistic) personality disorders. Kasen et al. propose that the association with cluster A and cluster C personality disorders may stem from two particular features of anxiety; namely separation anxiety (i.e., anxiety induced by social situations outside of immediate family) and social phobia (i.e., a more general fear and avoidance of social situations). Kasen et al. suggest that the presence of these features may lead to avoidance of social interactions during childhood, which leads to increased levels of anxiety and a preference for seclusion. This may in turn hinder the development of social skills and lead to further isolation, beginning a cyclical and persistent pattern of behaviour that resembles part of the diagnostic criteria for cluster A and cluster C personality disorders.

The pathoplasty hypothesis. Whilst the vulnerability and scar hypotheses propose that personality and anxiety are causally related, other models suggest that they need not be. The Pathoplasty hypothesis, for example, proposes that personality and anxiety are related, but indirectly through variables that mediate this relationship. For example, very high levels of neuroticism may decrease one's awareness of positive aspects of their abilities and increase one's awareness of the negative aspects. Such a disposition might then contribute to avoidance of, or intense anxiety in, social activities as a result of elevated fears of scrutiny. Thus, neuroticism does not directly cause anxiety but increases the risk via its impact on self-efficacy judgements. However, very little empirical research has been conducted on the pathoplasty hypothesis in the context of anxiety.

Schmidt and Bates (2003) provide some evidence in support of a pathoplastic relationship between personality and clinical levels of anxiety. In a study of 147 patients diagnosed with Panic Disorder, Schmidt and Bates examined whether anxiety sensitivity (i.e., the belief that anxiety can be harmful) impacted on comorbidity, medication use and disorder status at 6-month follow-up. The results of the study suggested anxiety sensitivity was significantly associated with a comorbid diagnosis of depression, medication use and several anxiety-related factors at 6-month follow-up, including self-reported anxiety, anticipatory anxiety and avoidance of anxiety sensations. These outcomes occurred despite many patients obtaining anxiety sensitivity scores typical of non-clinical participants. Thus, the results suggest that anxiety sensitivity has a considerable influence on the expression and course of Panic Disorder without necessarily impacting on the diagnosis itself.

The common cause hypothesis. The vulnerability, scar and pathoplasty hypotheses all assume that anxiety and personality are separate constructs and have the potential to influence each other, either directly or indirectly. However, the common cause model proposes that anxiety and personality are simply manifestations of the same underlying etiology (Kotov et al., 2010). Several large-scale studies support this hypothesis, suggesting that some features of personality and anxiety have shared underlying genetic predispositions (Bienvenu, Hettema, Neale, Prescott, & Kendler, 2007; Hansell et al., 2012; Hettema et al., 2006; Hettema, Prescott, & Kendler, 2004).

The most recent study performed by Hansell et al. (2012) examined the extent of genetic overlap between anxiety and neuroticism in 2459 twins (including 2268 pairs) aged 12-25 years. Hansell et al. reported strong correlations between neuroticism scores on the Junior Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) and NEO-FFI (Costa & McCrae, 1992), and anxiety symptoms assessed via the PSYCH-14 subscale of the Somatic and the Psychological Health Report (Hickie et al., 2001). Furthermore, 56% of the overlap between neuroticism and anxiety could be explained by commonalities in genetic makeup. Thus, Hansell et al.'s study provides strong support for the argument put forward by the common cause hypothesis.

Another large-scale study incorporating more than 8000 twins conducted earlier by Hettema, Prescott and Kendler (2004) reported even stronger genetic associations. The study examined the extent of genetic and environmental overlap between neuroticism, assessed via the Eysenck Personality Questionnaire-Short Form (Eysenck & Eysenck, 1975), and lifetime Generalized Anxiety Disorder, assessed via the Structured Clinical Interview for DSM-III-R (Spitzer & Williams, 1985). Whilst only a small proportion of environmental risk factors were shared between neuroticism and lifetime occurrences of Generalized Anxiety Disorder, Hettema et al. concluded that “the genetic factors underlying neuroticism are nearly indistinguishable from those that influence liability to Generalized Anxiety Disorder” (p. 1585). Hence, the study advocates strongly for the idea that neuroticism and Generalized Anxiety Disorder have much in common with regard to etiology and provides further support for the common cause hypothesis.

In an equally large follow-up study published shortly after, Hettema et al. (2006) examined genetic contributions to both neuroticism, using the Eysenck Personality Questionnaire-Short Form (Eysenck & Eysenck, 1975), and a range of anxiety disorders, including Generalized Anxiety Disorder, Panic Disorder, Agoraphobia, Social Phobia, Animal Phobia and Situational Phobia. The results largely supported those findings reported in the previous study (Hettema et al., 2004), suggesting Generalized Anxiety Disorder shared considerable genetic overlap ($r = .77$) but little environmental overlap ($r = .24$) with neuroticism. The results were similar for the remaining anxiety disorders assessed, with correlations for genetic overlap with neuroticism ranging between .58 (for Animal Phobia) and .82 (for Social Phobia), and correlations for environmental overlap with neuroticism ranging between .05 (for Animal Phobia) and .27 (for Agoraphobia). Thus, the follow-up study by Hettema and colleagues again provides strong support for the common cause hypothesis.

A fourth study, undertaken by Bienvenu et al. (2007), also investigated the genetic basis of personality traits and specific anxiety disorders. Again, the study reported results consistent with the common cause model. A total of 7800 twins were assessed on measures of neuroticism and extraversion (via the Eysenck Personality

Questionnaire-Short Form, Eysenck & Eysenck, 1975) as well as for Social Phobia, Agoraphobia and Animal Phobia (via the Diagnostic Interview Schedule, Version III, Robins et al., 1989). Bienvenu et al. reported that any genetic predisposition to Social Phobia and Agoraphobia could be accounted for entirely by the genetic predisposition to neuroticism and extraversion. Furthermore, all three anxiety disorders shared considerable genetic overlap with neuroticism alone.

In summary, considerable evidence also exists for a relationship between anxiety and features of personality. The literature offers four hypotheses depicting the relationship between anxiety and specific features of personality. These hypotheses are conceptually similar or identical to the models provided in the literature that attempt to account for the relationship between personality and depression. As with depression, empirical evidence within the anxiety literature is available to support each of these hypotheses, although there is particularly strong support for the common cause hypothesis. As with depression, it is possible that personality and anxiety are associated with one another through complex etiological processes as well as both direct and indirect influences on each other.

CHAPTER 4

THEORETICAL ACCOUNTS OF MEMORY COMPLAINTS

Key Points Addressed in Chapter Four

- Theory on subjective memory complaints has developed slowly over the past 20 to 25 years.
- Four models attempting to predict memory complaints that incorporate affect and/or personality have been proposed: the Memory Self-Efficacy Framework, the Social Support Model, the Mediation Model and the Clinically-Differentiated Model.
- The Memory Self-Efficacy Framework proposes that mood state or physiological arousal can impact on subjective judgements of memory abilities through pessimism and hopelessness as well as associated physiological experiences (e.g., shakiness) being interpreted as a vulnerability to poor performance.
- The final version of the Social Support Model proposes that memory complaints are directly predicted by depressed mood, which in turn, is directly predicted by social support.
- The Mediation Model proposes that depression impacts on memory complaints via its impact on negative cognitive bias (e.g., feelings of hopelessness and low self-esteem).
- The Clinically-Differentiated Model proposes that both affective states and personality traits impact on memory complaints but also that personality traits can impact on affective states as well.
- Two major limitations to theory attempting to predict memory complaints are a lack of empirical studies testing these theories as well as a lack of consideration for personality characteristics in the prediction of memory complaints.

CHAPTER 4: Theoretical Accounts of Memory Complaints

Whilst the structure and function of memory has been one of the most heavily researched topics across social and cognitive psychology (Kurtz-Costes, Schneider, & Rupp, 1995), emphasis on the subjective aspects of memory functioning has gained momentum only over the past 20 to 25 years. Furthermore, in contrast to much of the cognitive psychology and neuropsychology literature, research into the subjective aspects of memory has been somewhat slow in its theoretical development and is in many cases not guided by theory at all. Much of the literature has disregarded relevant theory and instead chosen to focus on the diagnostic implications of memory complaints (e.g., Gallassi, Bisulli, Oppi, Poda, & Felice, 2008; Harwood et al., 2004; Jessen et al., 2007).

However, four models that include aspects of affective distress and/or features of personality have been proposed that attempt to provide an explanation of what factors are associated with, or predictive of, memory complaints: the Memory Self-Efficacy (MSE) Framework (Berry, 1999), Chan et al.'s (2007) Social Support Model, Crane et al.'s (Crane, Bogner, Brown, & Gallo, 2007) Mediation Model and Niederehe's (1998) Clinically Differentiated Model (CDM). The MSE Framework, Chan et al.'s model and Crane et al.'s model each speculate on the potential influences of affective state on subjective memory complaints. Niederehe's CDM is the only model to incorporate the influence of characteristics of personality. This chapter summarizes the pertinent components of these four theories and comments on potential deficiencies in the memory complaint literature with regard to affect and personality.

The Memory Self-Efficacy Framework

The MSE Framework (Berry, 1999) is a model depicting a person's beliefs and judgements pertaining to their memory abilities and is derived directly from Bandura's (1997) Self-Efficacy Theory. Like Bandura's theory, the MSE framework primarily speculates on the manner in which beliefs about one's abilities impact on task performance; that is, how beliefs about one's memory impact on memory task performance. Whilst the current thesis is primarily concerned with predictors of the subjective aspects of memory functioning (i.e., beliefs about one's own memory,

rather than objective memory performance), the MSE framework is still relevant to the current study in that the model also speculates on several factors that may impact on subjective memory judgements, including physiological arousal and mood state.

The model is composed of four chronologically-arranged sections; sources of MSE, MSE itself, mediating effects of MSE, and task performance (see Figure 1). The first two components of the model (i.e., MSE and its sources) are discussed below, given their relevance to this thesis. Since the second component (MSE itself) is arguably the most fundamental part of the model, the following section first describes how the framework conceptualises MSE, followed by the manner in which psychological state or mood is hypothesized to influence it. The final two components of the model (mediators of MSE and memory performance) are designed to explain how beliefs about memory impact on memory task performance. These components are not directly relevant to the aims of this thesis and for the sake of brevity are not discussed here.

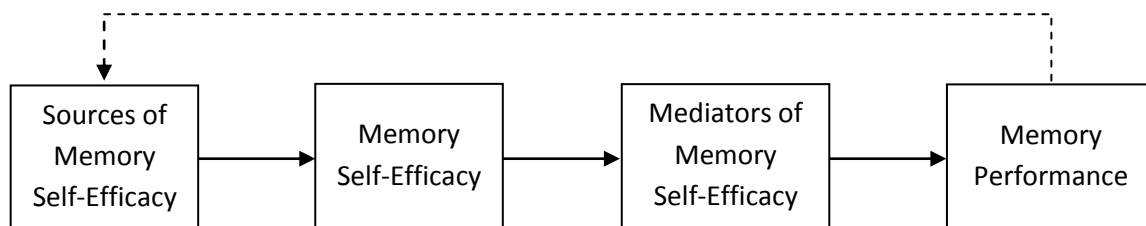


Figure 1. The chronological association between components of the Memory Self-Efficacy framework (adapted from Berry, 1999).

Berry (1999) describes MSE as a changeable and self-evaluating collection of beliefs and judgements pertaining to one's ability to perform memory tasks. For the most part, it has been operationally defined either through items developed within the framework of Bandura's Self-Efficacy Theory (e.g., Beaudoin, Agrigoroael, Desrichard, Fournet, & Roulin, 2008; Berry, West, & Dennehey, 1989) or through scales pertaining to common types of memory problems derived through factor analysis (e.g., Dixon, Hultsch, & Hertzog, 1988; Gilewski et al., 1990). MSE defined via Self-Efficacy Theory simply reflects an individual's belief in their own ability to

successfully complete a specific memory task. For example, the Memory Self-Efficacy Questionnaire (Berry et al., 1989) asks, “If a friend asked me to do 10 errands, five minutes later I could remember two of the errands I had to do”; to which the individual responds with whether or not they agree (Yes or No) and how confident they are (as a percentage). Factor analytic scales, however, are generally designed to assess memory competence in a variety of contexts, rather than ability for a specific task. For example, the MFQ (Gilewski et al., 1990) asks an individual to rate (on a Likert scale of 1 to 7) the extent of memory problems they experience with names, faces, appointments, directions, phone numbers and various other tasks and stimuli, which can then be summed together to provide an overall measure of memory complaint.

Mood State and Physiological Arousal as a Source of Memory Self-Efficacy

The MSE framework proposes that such judgements about one’s own memory abilities are based on input from four sources; (1) mastery experiences, (2) modelling or vicarious experience, (3) verbal persuasion, and (4) physiological arousal or mood state. The model speculates little on inter-relationships amongst the four sources, though each is proposed to contribute to MSE judgements (Berry, 1999). The MSE framework also proposes that the relationship between physiological arousal or mood state and subjective memory judgements is a direct one, such that arousal or mood state directly influences memory complaints (Berry, 1999).

Bandura (1997) emphasizes that because high levels of arousal have the potential to adversely affect task performance, people typically anticipate that their performance will be better when little or no physiological arousal is present. Thus, a person experiencing high levels of anxiety and associated physiological arousal (e.g., increased heart rate, shakiness, sweating) during or prior to a memory task will interpret these experiences as a vulnerability to poor performance. According to the MSE framework, such feelings of vulnerability would both reduce one’s self-efficacy and increase the likelihood of memory complaints being made. Similarly, negative mood states have the potential to increase the likelihood of memory complaints as a result of distorted perception. Depression, for example, is often associated with increased feelings of pessimism (Maltby, Lewis, & Hill, 1998) and

hopelessness (Nekanda-Trepka, Bishop, & Blackburn, 1983), both of which would presumably increase memory complaints.

The Social Support Model

Chan et al.'s (2007) Social Support Model was generated primarily to predict memory complaints in Human Immunodeficiency Virus (HIV) patients. However, little exploration has been carried out to examine whether or not this model generalizes effectively to non-HIV populations. For this reason, and because it incorporates concepts relevant to memory complaints more generally, it is incorporated here. Chan et al. provide two versions of the model; an initial model based on intuition and a simplified final model based on the results of a regression analysis.

Chan et al.'s (2007) initial model is composed of five chronologically-arranged factors, ending with memory complaints. Objective memory performance and depressive mood are postulated as the two predictors of memory complaints, such that poorer objective memory performance and a more severe depressed mood both increase the likelihood of memory complaints being made. Depressive mood is then also proposed to be predicted by medical symptoms and social support, such that a greater number or more severe medical symptoms and less social support both increase the likelihood or severity of the depressed mood.

Following an empirical study, Chan et al. (2007) made adjustments to the initial model to reflect the results obtained. The final model was adjusted to incorporate three chronologically-arranged factors, suggesting subjective memory complaints could be explained primarily by a depressive mood, which in turn could be explained primarily by social support. That is, poor social support is suggested as a risk factor for depressive mood, which consequently serves to increase the number or severity of complaints made about memory. Notably, Chan et al.'s Social Support Model suggests a direct relationship between depressive mood and subjective memory complaints.

The Mediation Model

Whilst the previous two models were designed primarily to understand the key factors associated with memory complaints, Crane, Bogner, Brown and Gallo's (2007) Mediation Model was instead designed to clarify the relationship between memory complaints and depression. The model assumes a link between memory complaints and depression but proposes that the link is mediated by negative cognitive bias (e.g., feelings of hopelessness and low self-esteem). That is, depression is predictive of memory complaints, though not directly associated with them.

Data from 299 older adults supported Crane et al.'s (2007) model, suggesting depression is associated with memory complaints but that this relationship can largely be explained by negative cognitive bias. When predicting subjective memory complaints on the MFQ, Crane et al. found three measures of negative cognitive bias (i.e., the Beck Hopelessness Scale, two questions assessing ideation about death and two questions assessing low self-esteem) were all found to be significantly associated with memory complaints. Likewise, depressive symptoms assessed via the Center for Epidemiological Studies Depression Scale were also found to be a significant predictor. However, when measures of both depression and negative cognitive bias were entered into a regression model predicting memory complaints, regression coefficients for depression tended towards zero, suggesting negative cognitive bias operates as a mediator between depression and memory complaints.

The Clinically Differentiated Model

Chan et al.'s Social Support Model (2007) and Crane et al.'s Mediation Model (2007) differ fundamentally from the MSE framework in that they were designed to predict memory complaints rather than memory performance. Likewise, Niederehe's (1998) CDM was also designed to predict memory complaints, though it also incorporates a number of other important demographic and contextual features. As with the MSE framework (Berry, 1999), the CDM incorporates the role of mood state. However, the model also includes the roles of aging, physiological disorders, contextual variables (e.g., how others respond to one's complaints) and, most notably, a distinction between the influences of psychological state and personality

trait factors. The structure of the model is outlined in Figure 2 (adapted from Niederehe, 1998). Given the complexity of the model and the number of directional relationships incorporated, the following section describes only how mood state and personality traits are proposed to influence memory complaints in the CDM.

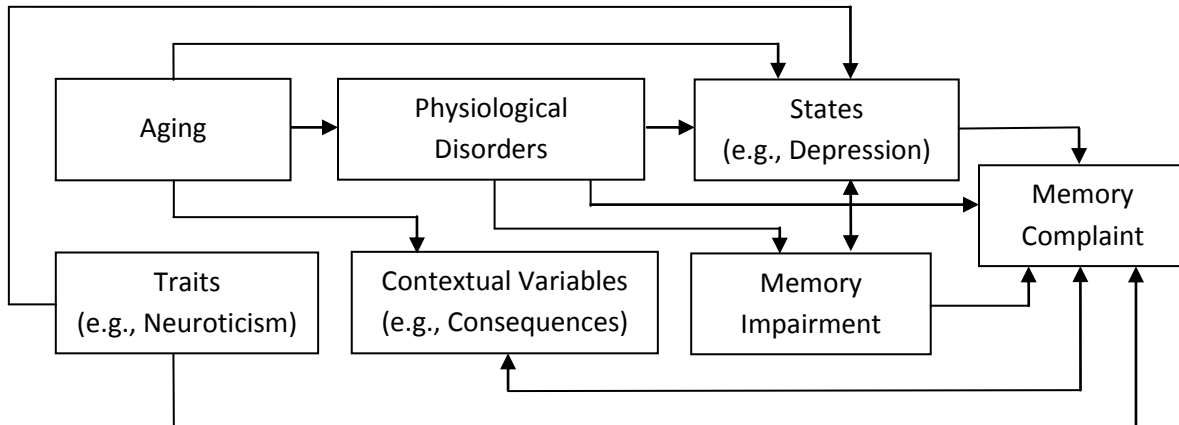


Figure 2. The hypothesized relationships among all variables in Niederehe's Clinically Differentiated Model (adapted from Niederehe, 1998).

State and Trait Influences on Memory Complaints

In the CDM (Niederehe, 1998), memory complaints are seen as the direct outcome of five factors: (1) transient affective states, (2) enduring personality traits, (3) actual memory impairment, (4) knowledge of the presence of physiological disorders and (5) various contextual variables. The model does not specify which variables tend to play a greater role in determining complaints, though all are believed to have a direct influence.

Affective states, whilst not defined by the CDM (Niederehe, 1998), refer to the fluctuating and temporary emotional experiences of an individual (Allport & Odbert, 1936); for example, one's heightened anxiety during a public performance. Niederehe's CDM suggests that the level of memory complaint exhibited by an individual will depend largely on their affective state at the time of the self-assessment. The memory complaints of individuals exhibiting characteristics of depression, for example, will presumably be greater in number and/or severity than

those not exhibiting such characteristics. As discussed in Chapter 2, there is considerable support for this relationship in the literature.

Personality traits are more stable than affective states and can be thought of as enduring patterns of behaviour through which one interacts with their environment (Allport & Odbert, 1936). The distinction between states and traits can be made predominantly on the basis of how consistent the patterns of behaviour are over time, where states fluctuate widely but traits remain fairly consistent (Zuckerman, 1983). Just as affective states are suggested to influence memory complaints in the CDM, so too do traits or characteristics of personality. For example, Niederehe (1998) suggests that someone who displays stronger neurotic tendencies will report more frequent or serious complaints of memory problems than someone who shows fewer neurotic tendencies. As reviewed in Chapter 3, there is also support for the notion that specific features of personality (particularly neuroticism) are predictive of memory complaints.

A feature of the CDM (Niederehe, 1998) that is pertinent to this thesis is the manner in which affective states and personality traits interact with one another, prior to their proposed influence on memory complaints. As is evident in Figure 2, Niederehe's model proposes that personality traits directly influence affective states as well as memory complaints. Thus, the model also proposes personality traits have a second (and indirect) influence on the number and/or severity of memory complaints via affective states. In essence, this aspect of Niederehe's model is consistent with the predisposition and pathoplasticity models outlined by Klein et al. (2011).

Limitations to Existing Memory Complaint Theories

As mentioned, one of the major limitations to memory complaint literature is the lack of empirical studies examining relevant theory. A vast number of published empirical studies that have examined the MSE framework (Berry, 1999) are available, though it was not designed primarily for predicting or explaining memory complaints. Alternatively, dedicated memory complaint theories, such as the Social Support Model (Chan et al., 2007), Mediation Model (Crane et al., 2007) and the

CDM (Niederehe, 1998) are designed to explain the etiology of memory complaints, though these theories have undergone little empirical investigation.

A second major limitation to memory complaint theory that is central to this thesis is that the impacts of personality factors on memory complaints have been largely overlooked. Each of the four models discussed make an attempt to delineate the impact of affect or mood on memory appraisals, though only Niederehe's (1998) CDM has incorporated personality factors. For example, the MSE framework proposes that mood state or physiological arousal impacts directly on memory self-efficacy judgements (Berry, 1999); Chan et al.'s (2007) Social Support Model proposes a direct effect of depression on memory complaints; and Crane et al.'s (2007) Mediation Model suggests depression impacts on memory complaints through cognitive bias. For these three models, however, no consideration is given to the simultaneous contribution of characteristics of personality to memory complaints. This is an important omission given clear evidence for an association between particular aspects of personality and affective states (discussed in Chapter 3).

Niederehe's (1998) CDM offers a more satisfactory theoretical explanation of the impact of personality, suggesting that personality factors impact on both subjective memory complaints and affect. However, as mentioned, this model has been subjected to little or no empirical investigation. What remains as a serious limitation to memory complaint theory then, is a realistic summary and investigation into the simultaneous contributions of affect and personality in the prediction of memory complaints.

SECTION ONE SUMMARY

Prior to addressing the study reported in the second section of this thesis, readers may find it useful to revisit the key points emphasised in Chapters 1 to 4. Whilst the number of empirical studies on memory complaints has grown rapidly over the past two decades, few have found relationships with objective memory performance strong enough to be of any clinical utility. Regardless of whether formal, established or more global measures of memory complaints are utilized, memory performance has typically been found to be at best only a weak predictor of memory complaints. Alternatively, research indicates a clear association between affective distress and memory performance, which further complicates the meaning of memory complaints.

More recent research suggests affective distress (particularly depression and anxiety) and specific features of personality (particularly neuroticism) provide a more fitting estimate of memory complaints. However, whilst a large number of memory complaint studies have examined the predictive utility of affective distress and personality characteristics, few or no studies have attempted to disentangle the relationship between them in order to better understand their unique contributions to memory complaints. The absence of such research is surprising not only because the relationship between affect and personality has been so fervently investigated, but because the benefits of understanding the unique contributions of affect and personality to memory complaints will have important theoretical and clinical implications in this area. Furthermore, such research will assist with the interpretation of much of the literature reviewed in Chapter 2 that examines the relationship between affective distress and memory complaints.

The manner in which affective distress and features of personality make unique contributions to memory complaints is largely dependent on how the two concepts are related. Whilst a great deal of research has demonstrated links between characteristics of personality and affective distress, considerable debate still exists with regard to whether causal mechanisms underpin them. For both depression and anxiety, their relationship with personality can be captured within three broad categories. One group of models suggests personality can increase a person's

vulnerability to affective distress, either directly or through a range of mediating factors. A second group of models suggests affective distress impacts on the presentation of personality, either temporarily or permanently. A third group of models propose that personality and affective distress are not directly related; instead, they are purported to either make up different ends of the same spectrum, or only appear to influence each other on account of common etiological factors.

In terms of memory complaint theory, four models have postulated on the relationship memory complaints hold with affective distress and/or personality. Three of the models make no mention of personality but rather speculate on what factors are responsible (either through mediation or indirectly) for the relationship between memory complaints and affective distress. A fourth model, Niederehe's (1998) CDM, provides a more satisfactory explanation of how personality and affective distress interact with each other prior to their influence on memory complaints. However, this model and other dedicated memory complaint models have been subjected to little empirical investigation. Instead, much of the memory complaint literature has focussed on investigating what neuropsychological deficits appear to be associated with complaints or what the clinical implications of such findings might be.

The second half of this thesis focusses on the current study. Chapter 5 outlines the rationale, objectives and questions for the research. Chapter 6 provides the methodology for the research, including details of participants, the materials utilized in the research and the procedures used for data collection. Chapter 7 reports the analyses (both preliminary and primary) used and the results obtained from these analyses. Finally, Chapter 8 provides a detailed discussion of these results in the context of the research questions, previous literature and relevant theory. This final chapter also includes discussion of the clinical implications of the results and future directions for research. A final summary of the thesis is then provided at the conclusion of Chapter 8.

SECTION TWO

CHAPTER 5

THE CURRENT STUDY

Key Points Addressed in Chapter Five

- The overarching objective of the current study is to examine the distinct role of affective distress in memory complaints made by older adults, beyond what can already be attributed to personality characteristics.
- The current study looks at both overall measures and specific features of depression and anxiety as predictors of memory complaints beyond characteristics of personality.
- In addition, the current study examines associations between affective distress and memory complaints in older adults for both applied and global measures of complaint.
- There are a number of possible benefits of this study, including improved interpretation of previous literature (empirical), improved understanding of the role of affective distress in memory complaints (theoretical) and improved mental health screening (clinical).
- Each of the objectives in the current study is examined within the context of a range of contextual variables, including memory performance, age, education, gender and premorbid intelligence.
- The chapter ends with a list of three research questions that are addressed in the final chapters of this thesis.

CHAPTER 5: The Current Study

The purpose of this chapter is to (1) outline the objectives of the study reported in this thesis, (2) provide a rationale for these objectives and (3) list the research questions that are investigated. It begins with the objectives for the current study, and then provides a rationale for the research by discussing the potential empirical, theoretical and clinical benefits of achieving them. The chapter finishes with a list of the research questions investigated in the current study, which leads into Chapter 6 (methodology) and Chapter 7 (analyses and results).

Objectives

There are three objectives for the study reported in this thesis. The first objective is to address the gap in memory complaint literature that concerns the distinct role overall measures of affective distress play in memory complaints made by older adults beyond what can already be explained by characteristics of personality. Empirical studies have shown depression and anxiety, as well as personality, to be consistently related to memory complaints. Despite this, little or no effort has been invested in examining the unique contributions of depression and anxiety to memory complaints within the context of personality. This may in part be attributable to research efforts mostly searching for ‘what’ is associated with memory complaints, rather than ‘why’ such factors might be important. This, in turn, may be attributable to difficulties associated with identifying the key predictors of memory complaints. Consequently, the current study attempts to untangle the unique roles of affective distress and personality in memory complaints made by older adults.

The second objective of the study reported in this thesis is to examine whether memory complaints are more robustly associated with overall measures of affective distress (i.e., depression and anxiety) relative to the specific features that comprise them (e.g., pessimism, lack of interest in daily activities, physiological arousal). Given depression and anxiety are characterised by a cluster of behavioural symptoms, it is possible that some of these symptoms exhibit stronger relationships with memory complaints than others. For example, it may be the case that overall measures of depression and anxiety incorporate some features that exhibit little or no

relationship with memory complaints – of course, such features would reduce the strength of the relationships between memory complaints and these overall measures of affective distress. Thus, the current study also examines specific features of depression and anxiety (in addition to overall measures) as predictors of memory complaints beyond personality.

As part of this second objective, the study also looks at whether unique contributions of affective distress towards memory complaints differ for specific features of depression and anxiety. That is, if specific features of depression and anxiety both uniquely contribute to memory complaints beyond personality, are these specific features conceptually similar? A handful of memory complaint studies have incorporated measures of both depression and anxiety (e.g., Derouesne et al., 1999; Potter & Hartman, 2006; Slavin et al., 2010), though little emphasis has been placed on understanding why or why not they exhibit differences in their predictive value, let alone understanding their contributions beyond personality. It may be the case that similar features of depression and anxiety are important in the context of memory complaints (e.g., low confidence); or it may be the case that distinct, unrelated features contribute from depression (e.g., feeling dispirited) and from anxiety (e.g., apprehension). Of course, it may also be the case that no specific features of affect are useful predictors of memory complaints beyond personality at all. Existing evidence provides little indication regarding these issues.

The third objective of the study reported in this thesis is to examine whether unique associations between affective distress and memory complaints, beyond personality, differ for memory complaints assessed via applied measures relative to an overall, global memory complaint measure. Whilst research suggests the associations memory complaints exhibit with affective distress and personality are relatively consistent regardless of whether complaints are assessed globally or via applied scenarios (see Chapters 2 and 3), the relative importance of affective distress and personality (assessed via their unique contributions) may differ according to how complaints are assessed. For this reason, the current study examines affective distress and personality as predictors of memory complaints assessed both via

applied situations (e.g., memory for recalling phone numbers) and via a global memory complaint measure.

Contextual Variables

Whilst the emphasis of the current study is on memory complaints, affective distress and personality, examining relationships between these concepts in isolation trivializes the inherent complexity of memory complaints and their predictors. For this reason, each of the objectives outlined for the current study are examined within the context of a number of other variables identified in the literature as important to memory complaints and the predictors being examined in the current study. These contextual variables include memory performance, age, education, gender and premorbid intelligence.

As discussed in Chapter 2, memory performance forms an important part of a triad of relationships between performance, complaints and affective distress. If not taken into account when observing relationships between memory complaints and affective distress, memory performance potentially forms a source of unexplained variance. For example, two individuals experiencing similar levels of affective distress but exhibiting vast differences in memory performance might be expected to show greater differences in memory complaints than two individuals experiencing similar levels of affective distress and memory performance. In addition, there is some evidence to suggest memory performance is also associated with specific features of personality (e.g., Coolidge, Segal, & Applequist, 2009; Cuttler & Graf, 2007; Schwartz, 1975). For this reason, the study reported in this thesis incorporates measures of memory performance when observing relationships between memory complaints, affective distress and personality (details regarding the measures are provided in Chapters 6 and 7).

A second contextual variable that has not been discussed to this point but that is still important in the context of memory complaints is age. According to Niederehe's (1998) CDM, age is assumed to contribute indirectly to memory complaints via other variables incorporated into the theory (including affective distress and an increased likelihood of physiological disorders). Likewise, empirical studies suggest age is related to a number of key variables in the context of memory

complaints, including affective distress (e.g., Henderson et al., 1998; Jorm, 2000; Wittchen & Uhlmann, 2010), memory performance (e.g., Luo & Craik, 2008; Small, 2001; Small, Yaakov, Tang, & Mayeux, 1999) and in some cases, memory complaints themselves (Gilewski et al., 1990; Larrabee & Crook, 1994). Given age may also act as a source of unexplained variance, it is incorporated into the current study as well.

A third contextual variable that was included in this study is the amount of formal education completed. Whilst education has not been incorporated into any of the four theories discussed in Chapter 4, several empirical studies have found it to be associated with memory complaints (e.g., Bassett & Folstein, 1993; Gagnon et al., 1994; Jonker et al., 1996; Schofield et al., 1997). Whilst few explanations have been provided for why this might be the case (beyond suggestions it may somehow influence sample selection), it may be that education and memory complaints are associated indirectly via their relationship with features of personality. For example, it is conceivable that more conscientious individuals might obtain a higher level of education and be more critical of their own abilities than less conscientious individuals. Such associations would give rise to an indirect relationship between education and memory complaints. Consequently, education is also incorporated into the current study.

There is also some evidence to suggest memory complaints are associated with gender, such that females tend to exhibit more severe or frequent complaints of memory problems than males (Gagnon et al., 1994; O'Connor et al., 1990). Again, few have speculated on possible reasons for the effect of gender on memory complaints, although one possible explanation for results reported in these previous studies is that females, on average, live longer than males (United Nations Department of Economic and Social Affairs, 2010). Consequently, female participants may exhibit higher rates of age-related memory problems, which in turn may impact on memory complaints. Alternatively, differences in memory complaints between males and females may be attributable to overall gender differences in personality characteristics or experiences in levels of affective distress. For this reason, gender is also incorporated into the current study.

The final contextual variable to be incorporated into the analysis is premorbid intelligence. Measures of premorbid intelligence are typically used as an estimate of peak intellectual function across the lifespan (e.g., McGurn et al., 2004). In the same way that differences in memory performance might contribute to unexplained variance in the relationship between memory complaints and affective distress, so too might premorbid intelligence. For example, two individuals experiencing similar levels of affective distress but exhibiting vast differences in peak intellectual functioning might be expected to show greater differences in memory complaints than two individuals experiencing similar levels of affective distress and premorbid intelligence. For this reason, premorbid intelligence is included in the current study as the final contextual variable.

Rationale

The potential benefits of such a study extend to the empirical and theoretical literature as well as to clinical practice with older adults. With regard to empirical literature, understanding how affect and personality interact in the prediction of memory complaints will assist with understanding the nature of the relationship between affect and memory complaints. Firstly, it will assist with interpreting previous research that has found affective distress to be a key predictor of memory complaints. It may be the case that depression, for example, is not directly related to memory complaints but rather an outcome of personality features that can account for both memory complaints and affect. Many studies continue to assume the relationship between affective distress and memory complaints is a direct one (e.g., Dux et al., 2008; Minett et al., 2005; Potter et al., 2009), and so such a finding would be important for providing clarity on the nature of this relationship. Secondly, the current study will provide clarity with regard to how useful affective distress and its features are as predictors of memory complaints, beyond personality.

Theoretical accounts of memory complaints have also largely overlooked how affect and personality interact with one another in the context of memory complaints. As mentioned in Chapter 4, Niederehe's (1998) CDM incorporates personality as a separate variable in the context of predicting memory complaints, yet this theory has been the subject of little or no empirical investigation. Whilst testing Niederehe's

CDM in its entirety is beyond the scope of the study reported here, it will shed light on key aspects of the theory, including how affect and personality interact with each other in their contributions to memory complaints. The study will allow for recommendations to be made with regard to how affect might more appropriately be conceptualised in the context of memory complaints in the MSE Framework (Berry, 1999), Chan et al.'s (2007) Social Support Model, Crane et al.'s (2007) Mediation Model and Niederehe's CDM.

The results of the study reported in this thesis are also important from a clinical perspective. As was discussed in Chapter 2, memory complaints exhibit medium-strength relationships with depression, which has prompted suggestions in the past that older adults complaining of memory problems should be screened for mental health problems (Harwood et al., 2004). However, neuroticism may also prove useful in the context of screening for mental health problems. Given neuroticism is associated with both affective distress and memory complaints (discussed in Chapter 3), such complaints in older adulthood may also be indicative of an ongoing risk of affective distress (even if this relationship is of an indirect nature). Understanding the unique contributions of neuroticism and affective distress to memory complaints will help to clarify whether this may be the case.

Research Questions

There are three research questions that are addressed in the study reported in this thesis. These research questions are derived directly from the objectives discussed earlier in this chapter. Each of the questions are examined within the context of memory performance, age, education, gender and premorbid intelligence. The questions to be addressed are:

1. To what extent are memory complaints made by older adults associated with overall measures of affective distress (in this case, depression and anxiety symptomatology) beyond personality characteristics and relevant contextual variables?
2. To what extent are memory complaints made by older adults associated with specific features of affective distress (i.e., specific features of depression and

anxiety symptomatology) beyond personality characteristics and relevant contextual variables? If specific features of both depression and anxiety symptomatology are predictive of memory complaints, are these specific features conceptually similar?

3. Do the associations between memory complaints and measures of affective distress beyond personality and relevant contextual variables differ for applied versus global measures of complaints?

CHAPTER 6

METHODOLOGY

Key Points Addressed in Chapter Six

- Participants who made up the sample were English-speaking, community-dwelling older adults between 65 and 90 years of age with little or no discernible impairment to vision, hearing, memory or language, and who had not previously received feedback pertaining to formal memory testing.
- Methods described by Cohen (1992) and Hsieh (1989) were used to determine required sample sizes for multiple linear regression and binary logistic regression analyses, respectively, which suggested a minimum sample size of 149.
- A total of 177 male and female older adults participated in the study.
- The study adopted a correlational approach and examines relationships between concurrent scores on measures of memory complaint, affective distress, personality, memory performance, age, gender, education and premorbid intelligence.
- Testing sessions for the research were carried out within the participants' homes and typically took between 90 and 100 minutes.

CHAPTER 6: Methodology

This chapter outlines the methodology utilized in the current study. The chapter begins with a brief discussion of the participants involved in the research, including criteria for participant selection and how the required sample size was estimated. Following this, the chapter details the measures utilized (and associated psychometric properties where available), research design and procedures for the testing session.

Participants

Criteria

In order to participate in the study, participants were required to be between the ages of 65 and 90 years. Whilst different age cut-offs have been used for participant selection in memory complaint research in the past (e.g., Pearman & Storandt, 2004, 2005; Smith et al., 1996), 65 to 90 years of age was chosen for the current study for three reasons. Firstly, 65 years of age was chosen as the lower cut-off because it was the recommended retirement age in Western Australia at the time the data was collected, which some studies have found is accompanied by changes in measures of cognitive functioning due to changes in day-to-day activities (Coe, Von Gaudecker, Lindeboom, & Maurer, 2012; Von Gaudecker, 2009). Secondly, it is commonplace in memory complaint literature to use a lower cut-off of 65 years of age (e.g., Gagnon et al., 1994; Geerlings, Jonker, Bouter, Ader, & Schmand, 1999; St John & Montgomery, 2002; Taylor et al., 1992; Wang et al., 2004). Thirdly, these age cut-offs fit well with testing and scoring procedures for the Wechsler Memory Scale – Fourth Edition (WMS-IV, Wechsler, 2009a), which stipulates different procedures for people over and under the age of 65 years and an upper limit of 90 years of age.

Given the measures utilized in the current study for verbal memory and premorbid intelligence (detailed later in this chapter) are largely dependent on English language skills, participants in the current study were also required to fluently speak English. Participants were not excluded from the study if they spoke English as an additional language, though it was noted and their first or preferred language(s) recorded. In addition, given most of the tasks completed during the

testing session for this study were dependent on satisfactory vision and hearing, participants with vision or hearing impairments that might affect performance (e.g., age-related macular degeneration, cataracts, tinnitus) were not included in the current study. Vision and hearing problems were screened via self-reports from participants prior to beginning the testing session.

In addition to restrictions pertaining to age, English language proficiency and satisfactory vision and hearing, participants were also screened for prior memory testing via self-report. Participants who had previously received formal testing of memory abilities (either for clinical purposes or via previous research participation) and who had received feedback on their performance were excluded from the current study given such feedback may exert excessive influence on memory complaint reporting. As well as this set of criteria, medication use, previous head injuries and evidence of stroke were also assessed via self-report and recorded. Participants were not excluded from the study on the basis of these factors, though they were recorded for the purpose of better informing the process of data screening where necessary.

Required Sample Size

The primary forms of analyses used in the current study include multiple linear regression and binary logistic regression. Various suggestions have been made regarding sample size calculations in linear and logistic regression, though given their widespread use in published literature, the current study opted for methods described by Cohen (1992) and Hsieh (1989). Cohen provides a method for determining adequate sample size in multiple linear regression based on the maximum number of predictor variables (k), anticipated effect size (f^2), specified alpha level (α) and required level of statistical power ($1 - \beta$). Although highly unlikely that all variables would enter the model, the maximum number of predictors that could enter any of the models in any of the regression analyses in the current study was 18, so k was set at this value. Medium-sized effects for affective distress and relevant personality characteristics (e.g., neuroticism) were anticipated based on previous literature, so f^2 was set at .15, as suggested by Cohen. Values for alpha (α) and statistical power ($1 - \beta$) were set at .05 and .80, respectively, given their conventional use. Where $k = 18$, $f^2 = .15$, $\alpha = .05$ and $1 - \beta = .80$ for a multiple linear

regression analysis, Cohen's methods suggest a minimum sample size of 149 participants.

For binary logistic regression, Hsieh (1989) provides a method for estimating required sample size based on alpha (α), statistical power ($1 - \beta$), the expected odds ratio (OR), the overall event proportion (P) and a multiplier for incorporating multiple predictors, which reflects the inverse of the squared multiple correlation coefficient between each individual predictor and the remaining predictors (i.e., $1 - \rho^2$). The overall event proportion (P) simply reflects the likelihood (expressed as a proportion) of the least likely result on the binary outcome variable. For example, if a sample of 120 participants includes 30 participants complaining of memory problems and 90 not complaining of memory problems, the least likely outcome is a memory complaint (since $30 < 90$) and $P = .25$ (i.e., $30 / 120$). Given the current study anticipated splitting participants into two groups for the binary logistic regression (i.e., high vs. low memory complaints) using a median value, it was anticipated that groups would be relatively even in size and that P would be no less than .40. Consequently a value of .40 was used. For the multiplier, a medium-sized correlation coefficient ($\rho = .30$) was used given some predictors included in the current study were likely to exhibit strong relationships (e.g., neuroticism and depression) and others were likely to share little or no association (e.g., age and premorbid intelligence). Again, values for alpha (α) and statistical power ($1 - \beta$) were set at .05 and .80, respectively. The recommended minimum sample size for binary logistic regression where $\alpha = .05$, $1 - \beta = .80$, $OR = 2$ (the minimum 'practically' significant effect for a binary variable, Ferguson, 2009), $P = .40$ and $\rho = .30$ is 84 participants. Thus, the recommended minimum sample size for either form of regression was 149.

Sample

Participants were invited to partake in the study via an advertisement placed in a local newspaper distributed widely around the Perth metropolitan area (see Appendix B). A total of 177 participants (115 females, 62 males) between 65 and 90 years of age ($M = 73.62$ years, $SE = 0.48$, Range = 66-90 years) participated in the study. Mean years of formal primary, secondary and post-secondary education

completed by the participants was 12.56 ($SE = 0.21$) and ranged from 8 to 24 years. Further participant details regarding levels of affective distress, characteristics of personality, premorbid intelligence and memory performance are detailed in Chapter 7, following discussion later in this chapter of how these variables were assessed.

Design

Research into memory complaints almost invariably adopts a quasi-experimental or correlational design. This is partly because it is often assumed memory complaints are an outcome of affective distress, personality characteristics and memory performance, and not the reverse (e.g., Amariglio et al., 2011; Mendes et al., 2008; Snitz et al., 2008), but primarily because it is difficult or unethical to manipulate many of the concepts included in such studies (e.g., personality or affective distress). The current study examines relationships between many variables that would be difficult to manipulate as would be required for an experimental design. However, the primary purpose for utilizing an experimental approach is to establish causation, which is of little interest to the research questions under investigation in the current study (indeed, causation is yet to be firmly established even between affective distress and personality – see Chapter 3). For these reasons, the current study adopted a correlational approach by examining relationships between concurrent scores on measures of memory complaints and measures of affective distress, personality, memory performance, age, gender education and premorbid intelligence.

Measures

Memory Complaints

A considerable number of measures have been developed for examining memory complaints (e.g., Derouesne et al., 1989; Schmand et al., 1996; Schmidt et al., 1999; Smith et al., 2000; Zelinski et al., 1980), yet there is little consensus in the literature regarding a gold standard. The Memory Complaint Questionnaire (Crook et al., 1992) and the GFF scale from the MFQ (Gilewski et al., 1990) are perhaps the most widely used measures in published literature. For the current study, the instrument was required to: (1) provide both an applied measure and a global measure of memory complaints, (2) be appropriate for use with older adults between

the ages of 65 and 90 years, and (3) demonstrate acceptable psychometric properties. Whilst both the Memory Complaint Questionnaire and GFF scale meet these criteria, the Memory Complaint Questionnaire was initially designed for use with older adults with memory impairment. Thus, given the sample for the current study was expected to comprise predominantly of healthy, community-dwelling older adults, the GFF scale was chosen as the measure for memory complaints.

The GFF scale comprises the first 33 items of the MFQ (Gilewski et al., 1990). All items are assessed on a 7-point Likert scale, resulting in self-report scores ranging from 33 (extreme problems with memory) through to 231 (no problems with memory). The GFF scale queries how often common memory problems arise (e.g., difficulties remembering names, faces and appointments), how often problems with recall arise during reading, and how well events can be recalled from last month to between 6 and 10 years ago. The GFF scale takes approximately 10 minutes to complete.

The first question from the GFF scale of the MFQ (Gilewski et al., 1990) was utilised as the global measure of memory complaint. The question asks participants, “How would you rate your memory in terms of the kinds of problems you have?” As with the remaining items on the GFF scale, the participant responds on a 7-point Likert scale, giving several possible outcomes ranging from ‘major problems’ (1 or 2) to ‘some minor problems’ (3 to 5) to ‘no problems’ (6 or 7). Based on these responses, participants were categorised into either a low or high memory complaint group based on an ad-hoc defined cut-off that provided two evenly sized groups. Categorizing participants into complaint groups is commonly used in the memory complaint literature (e.g., Amariglio et al., 2011; Minett et al., 2008; Snitz et al., 2008) and the process for creating these groups in the current study is detailed in Chapter 7.

The MFQ was developed from the 92-item Metamemory Questionnaire (MQ; Zelinski et al., 1980) via exploratory factor analysis, which was used to remove redundant items that did not load significantly on any one factor (one of which is the GFF scale). Across all scales, Gilewski, Zelinski and Schaie (1990) reported excellent test-retest reliability on the MFQ over a three year period (goodness-of-fit

= .98). In addition, the internal consistency for the GFF yielded a Cronbach's alpha value of .94, suggesting very high reliability of items within each scale.

Demographic characteristics (age, education and overall health) were found to account for only a small proportion (9%) of the variance across all scales of the MFQ, suggesting good resilience to these factors. The GFF scale also demonstrates good concurrent validity. After partialling out the effects of depression, health and education, concurrent validity was tested via comparisons with various laboratory and clinical tests of memory (Zelinski, Gilewski, & Anthony-Bergstone, 1990). The GFF scale was a significant predictor of performance on word recall and recognition tasks, various clinical tests assessing cognitive function (including the mini-mental state examination) and diary reports of memory failures.

Affective Distress

As discussed in Chapter 2, levels of affective distress (particularly depression, but also anxiety) are often reported to be associated with memory complaints. Given the current study intended to utilize a community sample and that only a small number of participants were expected to meet formal diagnostic criteria for depressive and/or anxiety disorders (particularly given involvement in the study required voluntarily contacting the researcher), the current study opted for a measure of depression and anxiety severity appropriate for use with both clinical and non-clinical samples. The full-length version of the Depression Anxiety Stress Scales (DASS, Lovibond & Lovibond, 1995b) is a 42-item self-report questionnaire used to assess symptoms of depression, anxiety and stress experienced over the previous week. Notably, it measures anxiety and depression states, rather than traits. For the current study, the 14-item scales pertaining to depression and anxiety were utilized to obtain measures of each of these concepts. Each of the 14 items within each scale contain a statement (e.g., 'I couldn't seem to experience any positive feeling at all'), to which the participant responds on a 4-point Likert scale ranging from 0 ('did not apply to me at all') to 3 (applied to me very much or most of the time), providing scores ranging from 0 to 42 for each of the scales. Categories reflecting severity of symptomatology are also provided in the DASS manual (Lovibond & Lovibond, 1995b). Depression scale scores can be categorized as normal (0-9), mild (10-13), moderate (14-20), severe (21-27) or extremely severe (28+). Likewise, anxiety scale

scores can also be categorized as normal (0-7), mild (8-9), moderate (10-14), severe (15-19) or extremely severe (20+). Together, the scales take approximately 10 minutes to complete.

The depression and anxiety scales of the DASS also assess a range of more specific features of affective distress. Subscales for the depression scale assess experiences over the past week of dysphoria, hopelessness, devaluation of life, self-deprecation, anhedonia and inertia (Lovibond & Lovibond, 1995b). The dysphoria subscale reflects feelings of sadness. The hopelessness subscale reflects a lack of hope or optimism for the future. The devaluation of life subscale reflects the extent to which a person feels that life is meaningless or hollow. The self-deprecation subscale provides a measure of feelings of self-worthlessness. The lack of interest/involvement subscale reflects a loss of interest or enthusiasm for day-to-day activities. The anhedonia subscale measures the loss of positive feelings and enjoyment. Finally, the inertia subscale reflects difficulty finding motivation and initiative. The manner in which scores on the scales and subscales were used in the current study is detailed in Chapter 7.

For the anxiety scale of the DASS, subscales include autonomic arousal, skeletal musculature effects, situational anxiety and subjective experiences of anxious affect (Lovibond & Lovibond, 1995b). The autonomic arousal subscale reflects an awareness of features associated with physical arousal, including increased heart rate, dryness of the mouth, breathing difficulties and difficulty swallowing. The skeletal musculature effects subscale assesses shakiness or trembling in the body. The situational anxiety subscale reflects worry, panic or anxiety associated with specific situations or tasks. Finally, the subjective experiences of anxious affect subscale reflects general feelings of panic, terror, fear or faintness.

A number of studies have examined the psychometric properties of the DASS. In non-clinical samples, research has found the DASS to possess good to excellent internal consistency reliability (Antony, Bieling, Cox, Enns, & Swinson, 1998; Crawford & Henry, 2003; Lovibond & Lovibond, 1995a; Norton, 2007), good construct validity (Henry & Crawford, 2005; Lovibond & Lovibond, 1995a) and be

resilient to demographic factors (Crawford & Henry, 2003; Norton, 2007). Crawford and Henry, for example, found internal consistency (assessed via Cronbach's Alpha) for the depression and anxiety scales to be .93 and .95, respectively, suggesting excellent consistency between items within each scale. In a study including both clinical and non-clinical groups, Antony et al. (1998) demonstrated that the DASS effectively distinguished clinically-diagnosed depression from physical arousal, psychological tension and feelings of agitation.

In clinical populations, the DASS has demonstrated equally good psychometric properties, with good to excellent internal consistency reliability (Brown, Chorpita, Korotitsch, & Barlow, 1997; Gloster et al., 2008; Page, Hooke, & Morrison, 2007), convergent validity (Brown et al., 1997; Gloster et al., 2008; Ng et al., 2007) and discriminative validity (Brown et al., 1997; Gloster et al., 2008). Studies have also indicated that the DASS discriminates well between various anxiety and mood disorder groups (Antony et al., 1998; Brown et al., 1997). Moreover, Antony et al. suggest the DASS can identify characteristics of depression and anxiety more effectively than several other established measures, including Hamilton's scales for assessing depression and anxiety (Hamilton, 1960; Maier, Buller, Philipp, & Heuser, 1988b) and the Beck Anxiety Inventory (Beck et al., 1988). Whilst there is some evidence for a ceiling effect on the DASS in clinically-depressed samples (Page et al., 2007), it was anticipated this would have little or no impact in the current study given a community sample was being targeted.

Personality

As with depression and anxiety, various features of personality have also been found to be associated with memory complaints (see Chapter 3). Neuroticism, in particular, has often been found to be a useful predictor of whether older adults report difficulties with their memory (e.g., Pearman & Storandt, 2004, 2005). To assess levels of neuroticism as well as the remaining four domains of the Five Factor Model of Personality (Digman, 1990), the current study utilized the NEO-FFI (Costa & McCrae, 1992). The NEO-FFI is a self-report questionnaire that provides a general, yet comprehensive evaluation of the five major domains of personality: neuroticism, extraversion, openness, agreeableness and conscientiousness. The

shorter NEO-FFI was chosen as the measure of personality in the current study rather than the longer, 240-item NEO Personality Inventory (Costa & McCrae, 1992) because it could be completed with the researcher present (the NEO Personality Inventory was too lengthy for this), thus reducing errors due to participants misinterpreting items or misunderstanding instructions. Furthermore, despite having fewer items, research has found the NEO-FFI to be an equally reliable and valid measure of personality (Costa & McCrae, 1992).

The NEO-FFI includes a total of 60 items, with 12 items allocated to each of the five domains of personality. Akin to the depression and anxiety scales of the DASS, each item consists of a statement (e.g., ‘I would rather go my own way than be a leader of others’), to which the participant indicates the extent to which they agree with that statement. Responses are recorded on a 5-point (0-4) Likert scale as ‘strongly disagree’, ‘disagree’, ‘neutral’, ‘agree’ or ‘strongly agree’, providing scores ranging from 0 to 48 for each measure of personality (whereby higher scores reflect higher levels of neuroticism, extraversion, openness to experience, agreeableness and conscientiousness). The neuroticism scale provides a measure of emotional stability. Items in the extraversion scale measure tendencies towards sociability and gregariousness versus reservedness and a preference for seclusion. The openness scale provides a measure of willingness to engage in new experiences versus more conservative behaviour and a preference for conventional methods. Items in the agreeableness scale measure the propensity to be cooperative and amiable as opposed to sceptical and antagonistic. The conscientiousness scale provides a measure of ambition and determination versus nonchalance. The NEO-FFI takes approximately 15 minutes to complete.

The NEO-FFI was developed from the NEO Personality Inventory (Costa & McCrae, 1985); a longer and more comprehensive self-report personality questionnaire. Items for the NEO-FFI were chosen from the NEO Personality Inventory primarily on the basis of factor loadings (those with the highest positive or negative loadings for the five given domains) but with consideration also given to diversity of item content (to maintain reliability and validity but not at the expense of conciseness) and proportion of positive and negative factor loadings (to control for

agreeable responding). Prior to the development of the NEO-FFI, the NEO Personality Inventory underwent rigorous development and validation protocol (see Costa & McCrae, 1985).

Internal consistency reliability (calculated using Cronbach's Alpha) for the neuroticism, extraversion, openness, agreeableness and conscientiousness scales were .86, .77, .73, .68 and .81 (Costa & McCrae, 1992), respectively, suggesting good to excellent agreement between items within each of the five scales (see also, Egan, Deary, & Austin, 2000). In addition, correlations between self-reports of personality characteristics obtained during development of the NEO Personality Inventory (McCrae & Costa, 1985) and during development of the NEO-FFI (Costa & McCrae, 1992) suggested good convergent and divergent validity. Correlations between items (i.e., convergent validity) across the five features of personality were .62 (Neuroticism), .60 (Extraversion), .56 (Openness), .57 (Agreeableness) and .61 (Conscientiousness), suggesting adequate reliability between items for corresponding domains. All convergent correlations were significant at $p < .001$. Additionally, correlations between scores on different personality features (divergent validity) were all below .20.

Memory Performance

Historically, memory has largely been conceptualised as a system composed of multiple components that (1) rely on distinct visual or auditory resources (Baddeley & Hitch, 1974) and (2) draw on different processes for information stored over varying periods of time (Atkinson & Shiffrin, 1968). Consequently, the current study opted for measures of memory that evaluated both verbal and non-verbal aspects of memory as well as over varying periods of time. Several measures are available for assessing verbal (e.g., Adams, 2003; Schmidt, 1996; Woodcock, McGrew, & Mather, 2001) and non-verbal (e.g., Benedict, 1997; Trahan & Larrabee, 1988; Williams, 1991) memory; however, the Wechsler Memory Scales provide perhaps the most widely used and comprehensively validated measures of memory currently available. The WMS-IV (Wechsler, 2009a) offers two subtests suitable for assessing immediate, delayed and recognition memory for both verbal and non-

verbal material. Consequently, the current study utilized the LM and VR subtests from the WMS-IV as measures of verbal and non-verbal memory.

Three measures of non-verbal memory were obtained using the VR subtest, including one measure of short-term memory (assessed via free recall) and two measures of long-term memory (free recall and recognition). Part one of the VR subtest (VR-I) offers a score for short-term non-verbal memory ranging from 0 to 43. Part two (VR-II), which is assessed after a 20 to 30-minute delay, provides two long-term non-verbal memory scores; a free recall score ranging from 0 to 43 and a recognition score ranging from 0 to 7. An optional 'copy' task in the VR subtest can also be administered to rule out problems associated with motor control or perceptual difficulties that may unknowingly impact on performance. Given participants were not screened for problems that could impair motor function (e.g., tremors), this task was also administered, providing a 'copy' score ranging from 0 to 43.

Three comparable measures of verbal memory were obtained using the LM subtest, including one measure of short-term memory (assessed via free recall) and two measures of long-term memory (free recall and recognition). Part one of the LM subtest (LM-I) provides a short-term verbal memory score ranging from 0 to 53. Part two (LM-II), also assessed after a delay, provides two long-term verbal memory scores; a free recall score ranging from 0 to 39 and a recognition score ranging from 0 to 23. For each of the measures obtained in the VR and LM subtests, higher scores signify better recall. The manner in which raw scores on all measures of verbal and non-verbal memory (including immediate, delayed and recognition measures) were used in the current study is detailed in Chapter 7.

All subtests in the WMS-IV have undergone extensive reliability and validity checks (Wechsler, 2009b). The average internal consistency (calculated via Fisher's z transformation) of the immediate (VR-I) and delayed (VR-II) components of the VR subtest for people aged between 65 and 90 years was excellent (.93 and .96, respectively), suggesting high reliability between items within each of the immediate and delayed measures of non-verbal memory. For immediate (LM-I) and delayed (LM-II) verbal memory, internal consistency was also excellent (.86 and .87 for LM-I and LM-II, respectively). Test-retest reliability over a mean of 23 days (using

Pearson Product-moment correlations) in people aged 65 to 90 years was good for VR-I and VR-II (.78 and .69) as well as for LM-I and LM-II (.79 and .77). Whilst these values are adequate, test-retest reliability is typically low in non-repeatable memory tasks due to improved performance resulting from practice effects (Wechsler, 1997, 2009b). Inter-scorer reliability (i.e., the rate of agreement between two independent scorers, as a percentage) for subtests requiring some degree of interpretation ranged between 96% and 97%, suggesting very high reliability with different scorers.

Extensive checking of concurrent validity (i.e., the degree to which test scores correlate with alternative measures) has also been undertaken for the WMS-IV (Wechsler, 2009b). After minor updates to both the VR and LM subtests in the fourth edition, correlations (calculated via Fisher's *z* transformation) between scores on the WMS-IV and WMS-III for VR-I, VR-II, LM-I and LM-II were .60, .62, .75 and .76, respectively, suggesting good concurrent validity. In addition, moderate correlations were found between scores on the Repeatable Battery for the Assessment of Neuropsychological Status (Randolph, Tierney, Mohr, & Chase, 1998) and both the immediate measures of the LM and VR subtests (.53 and .48, respectively). Moderate correlations were also reported for the delayed measures of the LM and VR subtests (.49 and .61, respectively). Finally, in two small-scale standardization studies (Wechsler, 2009b), healthy age and education-matched controls performed significantly better than participants with Alzheimer's disease and Mild Cognitive Impairment (MCI) on VR-I, VR-II, LM-I and LM-II (all *ps* < .01). All of these results suggest good concurrent validity.

Premorbid Intellectual Functioning

Measures of premorbid intellectual functioning are often used in studies assessing memory and associated concepts (e.g., Christensen et al., 1997; House, St. Pierre, Foster, Martin, & Clarnette, 2006; Schmand, Jonker, Geerlings, & Lindeboom, 1997) because they provide an estimate of intelligence prior to many forms of cognitive decline. There are several different measures of premorbid intellectual functioning (e.g., see Lowe & Rogers, 2011), though perhaps the most widely used is the National Adult Reading Test (NART, Nelson, 1982; Nelson &

Willison, 1991). The NART requires participants to read aloud 50 orthographically-irregular words (e.g., *ache*, *subtle*, *phlegm*). The test provides an estimate of premorbid intelligence utilizing knowledge of words that are unlikely to be correctly pronounced without previously having encountered them (given the words do not conform to typical English orthographic rules).

Many studies have indicated that NART scores provide an accurate measure of premorbid intellectual functioning in healthy elderly people (Bright, Jaldow, & Kopelman, 2002; Crawford, Deary, Starr, & Whalley, 2001; Schretlen, Buffington, Meyer, & Pearlson, 2006). Although Mathias, Bowden and Barrett-Woodbridge (2007) found NART scores underestimated the intellectual quotient (IQ) scores of younger adults (aged 18-60) on the Wechsler Adult Intelligence Scale – Third Edition (Wechsler, 1997), it was found to be a better predictor of IQ scores than the Wechsler Test of Adult Reading (Wechsler, 2001); an alternative reading test for estimating intelligence that was co-normed with the Wechsler Adult Intelligence Scale – Third Edition. For this reason, the NART was used to assess premorbid intelligence in this study. The NART takes around five minutes to complete, providing a score from 0 to 50, representing the total number of words mispronounced (errors) in the 50 item list. Appendix C provides a summary of all measures used in this study.

Procedure

Prior to data collection, ethics approval was obtained for the current study from the Edith Cowan University Ethics Committee. Given testing involved an assessment of depression and anxiety symptomatology, a procedure was put in place for participants who consistently reported the presence of symptoms of affective distress (as assessed via the DASS). Given time did not permit for DASS responses to be scored during the testing session, participants were briefly queried about their responses at the completion of the questionnaire. Participants who reported few symptoms of depression or anxiety on the questionnaire and who recounted few day-to-day difficulties with regard to mental health were not queried further. Participants who reported several symptoms of depression or anxiety on the DASS (i.e., several items scored as 2 or 3), or who reported day-to-day difficulties not captured by the

DASS, were provided with contact details for the Edith Cowan University Psychological Services Clinic, *beyondblue* (a depression research and services foundation) and *Lifeline* (a telephone crises support service). Suicidal ideation and self-harm were examined in participants provided with these contact details. No participant reported self-harming or a desire to end their life.

All testing for the current study was carried out in a quiet room within the homes of participants. Prior to testing, an information sheet was provided to participants outlining the purpose of the study and the risks and benefits of participating (see Appendix D); any questions participants had about the research were then clarified. Informed consent was obtained from all participants prior to commencing any of the testing (see Appendix E). Before beginning the testing session, various details were collected from participants, including their date of birth, gender, medication use as well as information pertaining to any known vision, hearing, language or memory impairments. A full list of details obtained from participants can be seen in Appendix F, which displays the information collected prior to testing.

The order of testing was determined primarily by time restrictions imposed by the VR and LM subtests. The order in which tasks were completed is outlined in Table 11, although small variations to this schedule occurred from time to time as a result of differences in the speed at which participants moved through the tasks. Using a stop-watch, a 20-minute interval was always maintained between the completion of VR-I and the commencement of VR-II. During this time, participants completed the LM-I subtest and began the NEO-FFI and DASS questionnaires (time permitting). Whilst the estimated combined time of completion for LM-I and the NEO-FFI was 20 minutes, participants sometimes required more or less time than this. Where the participant completed LM-I and the NEO-FFI in less than 20 minutes, they were asked to begin filling in the DASS until 20 minutes had elapsed.

When 20 minutes had elapsed (regardless of where participants were up to on the NEO-FFI or DASS), they were asked to stop filling in the questionnaires and the VR-II and LM-II tasks were administered. No participant completed all three tasks (LM-I, NEO-FFI and DASS) within the 20-minute period between completion of

VR-I and commencement of VR-II. Following completion of the VR-II and LM-II tasks, participants were invited to have a short break (5 to 10 minutes). Following the break, the VR-II copy section of the VR subtest was administered and any remaining questions on the NEO-FFI and DASS questionnaires were completed. The GFF scale from the MFQ and NART were completed last. The procedure for each of the tasks completed is described in more detail in the remaining sections of this chapter. All scoring was carried out at completion of the testing session. In total, the entire testing session (including break and collection of personal information prior to testing) typically lasted between 90 and 100 minutes.

Table 11

Order of Tasks Completed During the Testing Session

Task	Measure(s)	Approximate Duration (minutes)
Memory	VR-I, LM-I	15
Questionnaires	NEO-FFI, DASS	15
Memory	VR-II, LM-II	20
Break	-	5 – 10
Screening	VR-II Copy	5
Questionnaires	NEO-FFI*, DASS*, GFF	15
Premorbid IQ	NART	5

Note: A gap of 20 minutes was always maintained between VR-I and VR-II. *Unfinished questions remaining from earlier in the testing session

DASS = Depression Anxiety Stress Scales, GFF = General Frequency of Forgetting Scale, LM-I = Logical Memory I, LM-II = Logical Memory II, NART = National Adult Reading Test, NEO-FFI = NEO Five-Factor Inventory, VR-I = Visual Reproduction I, VR-II = Visual Reproduction II.

Visual Reproduction I

VR-I was administered according to the procedure outlined in the WMS-IV administration and scoring manual (Wechsler, 2009a). During VR-I the participant was asked to briefly view and then draw from memory five different designs (line drawings). Each design was presented by itself for 10 seconds (measured via stopwatch), at which point the design was concealed and the participant asked to

draw it from memory using a pencil and booklet provided. Participants were able to make use of an eraser provided to them during the task to make any corrections they felt necessary. The VR-I task took participants approximately 10 minutes to complete. A countdown was initiated (using the stopwatch) at the end of VR-I to monitor when 20 minutes had elapsed and when VR-II was to be administered.

Logical Memory I

As with VR-I, LM-I was administered according to the procedure outlined in the WMS-IV administration and scoring manual (Wechsler, 2009a). During LM-I the participant was verbally presented with two short stories. After each short story, the participant was asked to verbalize everything they could recall about the story, as close to verbatim as possible. To allow for an adequate baseline in participants who experience difficulty in recalling the information, the first story is presented twice prior to moving on to the second short story. No time limit was imposed on participants during their attempts to recall the short stories and responses were recorded using a digital audio recorder for later scoring. The LM-I task took participants approximately five minutes to complete.

NEO Five-Factor Inventory

Following the LM-I task, participants commenced filling in the NEO-FFI questionnaire. The NEO-FFI was administered according to instructions provided in the NEO-FFI manual (Costa & McCrae, 1992) and on the front of the NEO-FFI questionnaire booklet. Participants were able to ask questions pertaining to the questionnaire whilst it was being completed. The questionnaire typically took around 15 minutes to complete. No time limit was imposed on participants when completing the NEO-FFI.

Depression Anxiety Stress Scales

If participants completed the NEO-FFI and 20 minutes had not yet elapsed since completion of the VR-I task, participants were asked to begin filling in the DASS. The DASS was administered according to the precise explanation provided on the DASS itself. Again, participants were able to ask questions pertaining to the questionnaire whilst it was being completed. No time limit was imposed on

participants and it typically took around 10 minutes to complete. If, whilst filling in the NEO-FFI and DASS questionnaires, 20 minutes elapsed since the completion of VR-I, participants were asked to put the questionnaires aside to complete them later in the session and the VR-II and LM-II components of the VR and LM subtests were completed.

Visual Reproduction II

Following a 20-minute delay after completion of VR-I, VR-II was administered. The VR-II task includes two parts that assess delayed free recall and recognition memory for non-verbal material. First, participants were asked to draw from memory the designs presented during VR-I, in any order (delayed free recall). The participants were then shown each of the original five designs, one at a time, which were presented amongst five other similar designs (not shown in VR-I). The participants were then asked to point out which of the designs matched the original design presented previously. Both parts of VR-II were administered according to the procedures outlined in the WMS-IV administration and scoring manual (Wechsler, 2009a). This second section of the VR subtest took participants approximately 10 minutes to complete.

Logical Memory II

LM-II was then administered following completion of VR-II. Given the 20-minute delay between completion of VR-I and the start of VR-II, and that LM-I and VR-II take approximately 5 and 10 minutes to complete, respectively; LM-II commenced around 25 minutes after completion of LM-I. This falls within the 20 to 30-minute range suggested in the WMS-IV administration and scoring manual (Wechsler, 2009a). As with VR-II, LM-II provides measures of both delayed free recall and recognition memory. To assess delayed free recall for verbal material, participants were asked to recount whatever they could recall from the two short stories read out in LM-I. To assess recognition memory, participants were asked a series of yes/no questions pertaining to the two short stories. Both parts of LM-II were administered according to the procedures outlined in the WMS-IV administration and scoring manual (Wechsler, 2009a). This section of the LM subtest typically took participants around 10 minutes to complete.

Break

Once the LM-II component of the LM subtest had been completed, participants were invited to take a short, 5 to 10-minute break from testing. During this time, participants were encouraged to get up, walk around, stretch and get a drink of water if required. The break was delayed until both the VR and LM subtests were complete to avoid inconsistent interference effects that might result from conversations arising during the break.

Visual Reproduction – Copy

After a 5 to 10-minute break, participants were asked to copy the five designs shown during the VR-I task. The designs were left in full view of participants until they had finished copying them and no time limit was imposed. The VR-II copy task is used to rule out possible motor control and/or visuo-constructional problems as well as poor attention to detail. Low scores on the copy component of the VR subtest indicate that lower scores on the VR-I and VR-II free recall tasks may be attributable to factors not associated with memory (e.g., tremors associated with medication use or poor motor control associated with apraxia). This component of the VR subtest was administered according to the procedures outlined in the WMS-IV administration and scoring manual (Wechsler, 2009a) and took participants approximately 5 minutes to complete.

General Frequency of Forgetting Scale

After completing the VR-II copy task, participants then completed the GFF scale from the MFQ. The GFF scale was completed in accordance with instructions provided by Gilewski, Zelinski and Schaie (1990) and according to instructions provided on the MFQ itself. Again, participants were able to ask questions while the questionnaire was being completed. No time limit was imposed on participants, though it typically took approximately 5 minutes to complete.

National Adult Reading Test

Following the GFF scale, participants completed the NART. The NART was administered in accordance with instructions provided in the test manual (Nelson, 1982). For the NART, participants were given the list of 50 orthographically-

irregular words and asked to read them aloud one at a time. Participants were allowed to ask questions prior to beginning the task (e.g., “Can I pass on a word?”). No time limit was imposed on participants but the task was typically completed within 5 minutes.

CHAPTER 7

ANALYSES AND RESULTS

Key Points Addressed in Chapter Seven

- Multiple linear and binary logistic regressions were conducted to examine measures of affective distress as predictors of GFF scores and global (high vs. low) complaint status beyond personality and within the context of memory performance, age, gender, education and premorbid intelligence.
- All assumptions for these analyses were met.
- Overall depression status and the presence of anhedonia both significantly predicted memory complaints assessed via GFF scores and global (high vs. low) complaint status.
- Overall anxiety status and the presence of situational anxiety significantly predicted memory complaints assessed via GFF scores.
- The presence of situational anxiety but not overall anxiety status significantly predicted global (high vs. low) complaint status.
- No measure of affective distress (either overall or specific) was a significant predictor of memory complaints assessed via GFF scores or global (high vs. low) complaint status with important measures of personality also in the model.

CHAPTER 7: Analyses and Results

This chapter outlines the analyses and results for the current study. It provides an outline of the analyses used to address each of the research questions, including how variables were operationalized for the analyses. The relevant assumptions of the analyses used are then discussed. Finally, the chapter details the results obtained for the study reported in this thesis.

Analyses

Two overarching forms of analyses were used to address the research questions presented in this chapter. To examine overall and specific features of depression and anxiety as predictors of memory complaints, beyond features of personality and the contextual variables, the current study employed two sets of regression analyses. To examine the capacity of these predictor variables to account for responses on the GFF scale, the study employed a series of four multiple linear regression analyses. Separate multiple linear regression analyses were carried out to examine (1) overall depression status, (2) specific depressive symptoms, (3) overall anxiety status and (4) specific anxiety symptoms as predictors of applied memory complaint scores within the context of personality, memory performance, age, gender, education and premorbid intelligence.

To examine affective distress, personality and the contextual variables as predictors of a global measure of memory complaint dichotomized as high versus low (details are provided in the next section on how memory complaints were dichotomized), a series of four binary logistic regression analyses were utilized. Again, separate regression analyses were employed to examine (1) overall depression status, (2) specific depressive symptoms, (3) overall anxiety status and (4) specific anxiety symptoms as predictors of high versus low memory complaints beyond personality and within the context of memory performance, age, gender, education and premorbid intelligence. Whilst discriminant function analysis is sometimes seen as preferable to logistic regression for assessing such relationships (see Tabachnick & Fidell, 2012), logistic regression was chosen as the preferred method of analysis in this case because (1) the outcome variable is binary rather than multinomial, (2) one of the predictor variables was categorical (i.e., gender), (3) the

major emphasis of the current study was to assess individual predictors rather than the overall efficacy of the model, and (4) a key assumption of discriminant function analysis (homogeneity of variance-covariance matrices) was not met. The precise manner in which variables were entered into the regression models for each of these analyses is addressed in the relevant sections in this chapter. The following section addresses how the variables included in the analyses were operationalized, including how scores for non-raw-score data were treated.

Variables Used in Analyses

For the analyses reported in this chapter, several of the variables utilized raw data, including applied memory complaints (raw scores on the GFF scale), personality (raw scores on the NEO-FFI personality scales), gender (female = 0, male = 1), education (years) and premorbid intelligence (NART errors). However, raw data was not used for global memory complaints, measures of affective distress, memory performance or age, given how they were assessed or the shape of their distributions. The following section details the variables used in the main analyses, including why raw scores for some of the variables were not utilized and how they were quantified for the regression analyses. As a reference, Appendix G provides (Pearson or Phi) correlations between all variables utilized in the analyses.

Memory Complaints

For applied memory complaints, raw scores from the GFF scale were utilized. The mean score on the GFF scale for the sample was 157.30 ($SE = 1.96$), which represents a mean score of 4.77 for individual items (on a scale from 1 to 7, with higher scores indicating lower levels of complaint). There was a small but significant effect of gender on GFF scores, $t(175) = 2.09$, $p = .038$, $d = .32$. Overall, GFF scores for females ($M = 160.28$, $SE = 2.38$) were significantly higher than for males ($M = 151.77$, $SE = 3.33$), suggesting females in the sample had fewer or less serious complaints of memory problems than males in the sample.

Global memory complaints were assessed using the first question from the GFF scale of the MFQ (Gilewski et al., 1990), which asks, “How would you rate your memory in terms of the kinds of problems you have?” Participants respond to

the question on a seven-point Likert scale, ranging from 1 (major problems) through to 7 (no problems). Data defined on a seven-point Likert scale is ordinal and so cannot be incorporated as a continuous measure that would be required for an outcome variable in a linear regression analysis. For this reason, global memory complaints were conceptualised as being either ‘high’ or ‘low’ according to whether they fell above or below an ad hoc defined cut-off. Cut-off values providing the most evenly sized groups were those of 1 to 4 (deemed the high complaint group) and 5 to 7 (deemed the low complaint group). According to headings provided on the MFQ, the high complaint group would incorporate those who felt they had major problems with their memory as well as those who felt they had a considerable number of noticeable minor problems. Participants in the low complaint group would incorporate those who felt they had few or only very minor problems, or those reporting no problems at all. Of the 177 participants in the sample, 88 (49.7%) were classified as belonging to the high complaint group and 89 (50.3%) to the low complaint group. This overall event proportion value of .497 (49.7%) for the high complaints group exceeds the minimum value of .40 utilized for estimating sample size (see Chapter 6, ‘Required Sample Size’). No significant effect of gender on global complaint status was found, $U = 3284.00$, $p = .318$, $r = .08$.

Affective Distress

Whilst depression and anxiety are among the most commonly reported mental health problems (e.g., Kessler et al., 2005), they are still reported in only a relatively small proportion of community-dwelling older adults (Beekman et al., 1998; Djernes, 2006; Fuentes & Cox, 1997; Steffens et al., 2000). For this reason, raw score data from the DASS scales and subscales each exhibited a very strong positive skew. Given (1) univariate normality is an assumption of linear models, (2) skewed data can reduce the strength of correlations and (3) transforming skewed data to normal can lead to difficulties with linearity (see Dunlap, Burke, & Greer, 1995) and interpretation, the current study opted for ad hoc defined cut-off values for the depression and anxiety scales to categorize participants as either ‘depressed’ or ‘not depressed’ and ‘anxious’ or ‘not anxious’ on the basis of clinical cut-offs specified in the DASS manual (Lovibond & Lovibond, 1995b). Grouping participants this way was also logical given the groups have meaningful applications.

Guidelines specified in the DASS manual (Lovibond & Lovibond, 1995b) provide cut-offs for depression and anxiety severity ratings ranging from ‘normal’, to ‘mild’, ‘moderate’, ‘severe’ and ‘extremely severe’. These categories are distinguished from one another on the basis of percentiles derived from the normative sample used in the development of the DASS (Lovibond & Lovibond, 1995b). The severity ratings of normal, mild, moderate, severe and extremely severe are separated by the 78th, 87th, 95th and 98th percentiles, respectively. For the current study, participants were categorized as depressed or not depressed and anxious or not anxious on the basis of normal versus above normal (i.e., mild through to extremely severe) levels. When dealing with raw scores, participants can be separated into these two groups using cut-offs of 0-9 (not depressed) and 10-42 (depressed) for depression, and 0-7 (not anxious) and 8-42 (anxious) for anxiety. These categories were coded as 0 (no depression or no anxiety) or 1 (depression present or anxiety present).

Given data for each of the individual DASS subscales also exhibited strong positive skews, participants were also placed into dichotomous categories for each of the seven subscales of depression and four subscales of anxiety. Clinical cut-offs are not provided for the subscales on the DASS as they are with the depression and anxiety scales. Furthermore, no clinical cut-off could be meaningfully derived for these subscales given the concepts they measure do not reflect a diagnosis per se. Therefore, participants in the current study were categorized either as having reported no subscale symptoms (e.g., dysphoria not reported) or some subscale symptoms (e.g., dysphoria reported); coded as 0 or 1, respectively.

The prevalence (and proportion) of participants scoring above nine on the depression scale or above seven on the anxiety scale are reported in Table 12. Prevalence rates are also reported for each of the symptoms measured by the subscales of the depression and anxiety scales of the DASS (i.e., symptoms reported vs. symptoms not reported). An effect of gender was found for overall anxiety status and self-deprecation status, on which females exhibited significantly higher rates than males for both. Rates of anxiety in females and rates of depression in both males and females were slightly higher in the current study than previously reported

in recent community samples (Fiske, Wetherell, & Gatz, 2009; Pirkis et al., 2009; Steffens, Fisher, Langa, Potter, & Plassman, 2009; Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010). This may be an outcome of the manner in which participants were allocated to groups here, though it is perhaps more likely attributable to the recruitment method utilized in the current study. Given this study recruited participants for a study on memory complaints, it is possible the sample included a large proportion of participants with subjective or objective memory problems; both of which are associated with depression (reviewed in Chapter 2).

Table 12

Prevalence Rates for Depression, Anxiety and Specific Features of Each

Measure	Prevalence (%)			
	Female	Male	Total	<i>r</i>
Depression	25 (21.7%)	8 (12.9%)	33 (18.6%)	.11
Dysphoria	49 (42.6%)	20 (32.3%)	69 (39.0%)	.10
Hopelessness	34 (29.6%)	15 (24.2%)	49 (27.7%)	.06
Devaluation of Life	29 (25.2%)	9 (14.5%)	38 (21.5%)	.12
Self-Deprecation	34 (29.6%)	8 (12.9%)	42 (23.7%)	.19*
Lack of Interest	39 (33.9%)	18 (29.0%)	57 (32.2%)	.05
Anhedonia	48 (41.7%)	26 (41.9%)	74 (41.8%)	.02
Inertia	59 (51.3%)	29 (46.8%)	88 (49.7%)	.05
Anxiety	22 (19.1%)	4 (6.5%)	26 (14.7%)	.17*
Autonomic	58 (50.4%)	23 (37.1%)	81 (45.8%)	.13
Skeletal	26 (22.6%)	10 (16.1%)	36 (20.3%)	.08
Situational	47 (40.9%)	29 (46.8%)	76 (42.9%)	.06
Anxious Affect	28 (24.3%)	14 (22.6%)	42 (23.7%)	.02

Note: Anxious Affect = Subjective Experiences of Anxious Affect, Autonomic = Autonomic Arousal, Situational = Situational Anxiety, Skeletal = Skeletal Musculature Effects

* $p < .05$

Personality Characteristics

Raw scores from the neuroticism, extraversion, openness, agreeableness and conscientiousness scales of the NEO-FFI were utilized as measures of personality in the analyses. Scores on each of the scales can range from 0 through to 48. Means and standard errors for each of the scales are presented in Table 13. A small but significant effect of gender was observed for scores on the conscientiousness scale, $t(175) = 2.51, p = .013, d = 0.38$. For this measure, females scored higher than males, suggesting slightly higher self-reported tendencies toward conscientious behaviour in female participants in the sample.

Table 13

NEO-FFI Scores by Gender for the Sample Utilized in the Current Study

Personality Measure	Mean Scale Score (Standard Error)			
	Females	Males	Total	<i>d</i>
Neuroticism	19.89 (0.68)	17.63 (0.94)	19.10 (0.56)	0.29
Extraversion	28.10 (0.53)	27.37 (0.79)	27.85 (0.44)	0.12
Openness	27.63 (0.52)	27.47 (0.68)	27.57 (0.41)	0.03
Agreeableness	33.10 (0.56)	31.44 (0.69)	32.51 (0.44)	0.27
Conscientiousness	34.77 (0.52)	32.56 (0.70)	34.00 (0.43)	0.38*

* $p < .05$

Contextual Variables

Memory performance. Six measures of memory were obtained from the tasks completed by participants in the current study. Scores for immediate, delayed and recognition memory are provided for verbal and non-verbal material by the LM and VR subtests, respectively. Whilst all of these measures could have been simultaneously entered into the regression analyses as measures of memory, incorporating predictors that are strongly related (which was anticipated, based on data presented by Wechsler, 2009b) in a single regression model can severely distort

coefficients and misrepresent their true relationships with the outcome variable. For this reason, a preliminary factor analysis was carried out to determine whether a smaller number of latent measures of memory could adequately account for memory performance. Raw scores from the immediate, delayed and recognition measures of verbal and non-verbal memory were subjected to Principal Axis factoring and a Direct Oblimin rotation. A non-orthogonal rotation was chosen because factors were expected to correlate to some degree, regardless of the underlying structure.

The Kaiser-Meyer-Olkin statistic (.78) indicated good to very good sampling adequacy (in addition, all six individual measures of memory exceeded .72), suggesting factor analysis was appropriate for analysing the data. Bartlett's test of sphericity indicated sufficiently-strong correlations between the measures, $\chi^2(15) = 560.82, p < .001$. Two factors had eigenvalues greater than 1, which each explained 57.3% and 20.5% of the variance in memory performance scores. The measures of verbal memory loaded heavily on the first factor; namely LM-I (.84), LM-II (.98) and LM-R (.65). The measures of non-verbal memory loaded heavily on the second factor; that is, VR-I (.89), VR-II (.87) and VR-R (.68). All other loadings ranged between -.07 and .05, suggesting two measures of memory were appropriate and that separate measures of verbal and non-verbal memory should be incorporated into the analyses. The correlation of .545 between the two factors was not strong enough to warrant concern for multicollinearity. Verbal and non-verbal memory factor scores derived from the factor analysis were utilized as measures of memory in both the multiple linear regression analyses and binary logistic regression analyses. No effect of gender was found for VR factor scores, $t(175) = 0.86, p = .393, d = 0.13$. However, a small effect of gender was observed for LM factor scores, $t(175) = 2.16, p = .032, d = 0.33$, whereby female participants marginally outperformed male participants.

To provide an indication of the sample's overall performance on the memory tasks utilized in the study, Table 14 details the mean, standard error and gender-based effect sizes for scaled scores on the LM-I, LM-II, VR-I and VR-II tasks (scaled scores cannot be derived for LM-R or VR-R). Scaled scores on the WMS-IV represent a participant's score relative to the normative sample on which the WMS-

IV was standardized. Scaled scores can range from 1 to 19 and have a mean of 10 with a standard deviation of three. According to means obtained for the sample utilized in the current study, scaled scores suggest participants scored slightly higher than the normative sample. Scaled scores ranged from 10.05 (for males on the LM-II task) through to 11.71 (for females on the VR-II task). The scaled scores presented in Table 14 suggest participants used in the current study performed equally well or slightly better than participants in the standardisation sample. No significant ($p < .05$) differences were found between males and females on any of the four measures of memory performance.

Table 14

Mean and Standard Error for WMS-IV Scaled Scores on the WMS-IV

Measure	Females	Males	Total	<i>d</i>
LM-I SS	11.63 (0.22)	10.92 (0.37)	11.38 (0.19)	0.27
LM-II SS	10.81 (0.23)	10.05 (0.34)	10.54 (0.19)	0.30
VR-I SS	11.65 (0.23)	11.65 (0.38)	11.65 (0.20)	0.00
VR-II SS	11.71 (0.26)	11.27 (0.37)	11.56 (0.21)	0.15

Note: LM-I SS = Logical Memory I Scaled Score, LM-II SS = Logical Memory II Scaled Score, VR-I SS = Visual Reproduction I Scaled Score, VR-II SS = Visual Reproduction II Scaled Score.

Individual scores from participants on the VR copy task suggested errors made on the VR-I and VR-II tasks were likely attributable to difficulties recalling the line drawings and not motor control or visuo-constructional problems, or poor attention to detail. The overall mean score (out of 43) for the VR copy task was 42.38 ($SE = 0.07$). No significant difference was found between females ($M = 42.39$, $SE = 0.08$) and males ($M = 42.35$, $SE = 0.12$) for this task, $t(175) = 0.25$, $p = .800$, $d = 0.04$. Only four participants (2.26%) made more than three errors on the VR copy task, two of whom scored 38 (five errors) and two 39 (four errors). All four participants obtained comparable scores for measures of verbal and non-verbal memory, suggesting the cause(s) of the errors made on the VR copy task likely did not drastically impair performance on the VR measures relative to their performance on the LM measures. For this reason, data from all participants was retained.

Age. The majority of participants who came forward to participate in the current study were at the younger end of the 65 to 90 years age spectrum. Consequently, as with scores on the depression and anxiety scales of the DASS, age also showed a strong positive skew. For reasons already outlined in the section detailing how depression and anxiety were operationalized, the age variable was also dichotomized (age categories are frequently utilized in memory complaint studies, see Aarts et al., 2011; Bay, Kalpakjian, & Giordani, 2012; Steinberg et al., 2013). For age, participants were divided into two groups using the value that provided the two most evenly sized groups. Ranges of 65 to 71 years (younger, $n = 88$) and 72 to 90 years (older, $n = 89$) provided the most evenly sized groups.

Table 15 details scores for both of the age categories for measures of memory complaints, affective distress, personality, memory performance, premorbid intelligence and education for participants in the current study. Small to medium-sized differences between the age groups were observed for inertia symptoms, openness scale scores and errors on the NART. Older participants were found to exhibit a greater likelihood of experiencing symptoms of inertia, exhibited lower levels of openness, and made more errors on the NART. Large effect sizes between the groups were found on the LM and VR factor scores, whereby older participants performed less well than younger participants on these tasks.

Gender. Of the 177 participants in this study, most were female ($n = 115$, 65.0%). Gender has the potential to play an important role in memory complaints, given some previous studies have found it to be related to memory performance (e.g., Pauls, Petermann, & Lepach, 2013; Persson et al., 2013), affect (e.g., McLean, Asnaani, Litz, & Hofmann, 2011; Parker & Brotchie, 2010), personality (e.g., Weisberg, DeYoung, & Hirsh, 2011) and memory complaints themselves (e.g., Holmen et al., 2013). In the current study, no differences were found between males and females on the original scaled scores for the WMS-IV, though a small difference was found on the LM factor scores used to characterize verbal memory performance. As noted earlier in the chapter, gender differences were also found for some measures of affective distress, personality, and for scores on the GFF scale.

Table 15

Mean (and SE) or Mean Rank for Key Variables According to Age Category

Measure	Mean (SE) or Mean Rank		Size of Effect
	Younger (65-71)	Older (72-90)	
GFF scores	157.74 (2.68)	156.87 (2.86)	$d = 0.03$
High vs. Low Complaints	85.23	92.73	$r = .08$
Depression	89.60	88.41	$r = .02$
Dysphoria	91.71	86.32	$r = .06$
Hopelessness	91.65	86.38	$r = .07$
Devaluation of Life	88.10	89.89	$r = .02$
Self-Deprecation	92.14	85.90	$r = .08$
Lack of Interest	90.67	87.35	$r = .04$
Anhedonia	89.21	88.79	$r = .00$
Inertia	97.30	80.80	$r = .19^*$
Anxiety	90.08	87.93	$r = .03$
Autonomic	85.71	92.25	$r = .07$
Skeletal	87.09	90.89	$r = .05$
Situational	90.22	87.79	$r = .03$
Anxious Affect	91.13	86.89	$r = .06$
Neuroticism	19.53 (0.77)	18.66 (0.80)	$d = 0.12$
Extraversion	27.98 (0.62)	27.72 (0.64)	$d = 0.04$
Openness	28.70 (0.59)	26.45 (0.56)	$d = 0.42^{**}$
Agreeableness	32.64 (0.69)	32.39 (0.57)	$d = 0.04$
Conscientiousness	34.11 (0.67)	33.89 (0.53)	$d = 0.04$
LM factor scores	0.32 (0.08)	-0.31 (0.11)	$d = 0.70^{***}$
VR factor scores	0.43 (0.08)	-0.43 (0.10)	$d = 1.03^{***}$
NART errors	8.77 (0.51)	10.35 (0.48)	$d = 0.34^*$
Education	12.90 (0.32)	12.22 (0.29)	$d = 0.24$

Note: Autonomic = Anxious Affect = Subjective Experiences of Anxious Affect, Autonomic Arousal, Education = Years of Education, GFF = General Frequency of Forgetting Scale, LM = Logical Memory, Situational = Situational Anxiety, Skeletal = Skeletal Musculature Effects, VR = Visual Reproduction.

* $p < .05$, *** $p < .001$.

Premorbid intelligence. Premorbid intelligence was assessed via the number of errors made on the NART. Across the entire sample, the mean number of errors (out of 50) made by participants on the NART was 9.56 ($SE = 0.36$). No difference was observed between the number of errors made by females ($M = 9.57$, $SE = .0.42$) and males ($M = 9.55$, $SE = 0.66$), $t(175) = 0.03$, $p = .973$, $d = .01$.

Education. Education was assessed via the number of years of formal primary, secondary and post-secondary education completed. The mean years of education completed by the sample was 12.56 ($SE = 0.22$). No difference was found between females ($M = 12.46$ years, $SE = 0.24$) and males ($M = 12.74$ years, $SE = 0.42$) with regard to the amount of formal education completed, $t(175) = 0.63$, $p = .528$, $d = .10$.

Assumptions for Primary Analyses

Prior to using or interpreting the regression analyses detailed below, it is a requirement that several assumptions of the data be met. Given binary logistic regression has relatively few assumptions, the following section applies mostly to the multiple linear regression analyses. However, binary logistic regression is incorporated where necessary. Assumptions of the analyses utilized in this chapter include: (1) appropriate levels of measurement for variables, (2) predictor variables being uncorrelated with external variables, (3) adequate sample size, (4) non-zero-variance in predictor variables, (5) absence of univariate and multivariate outliers, (6) linearity between all variables in the regression analysis, (7) no multicollinearity (or singularity) between predictor variables, (8) homoscedasticity of residuals and (9) normally distributed residuals (addressed in Field, 2005). The following section describes the process by which each of these assumptions were examined, as well as any actions taken.

Appropriate Level of Measurement

Field (2005) stipulates that it is a requirement of multiple linear regression that all predictors must be either continuous (i.e., interval or ratio scale) or categorical (with two categories only) and that the outcome variable must be either continuous and free of constraint (in the case of multiple linear regression) or dichotomous (in the case of binary multiple logistic regression). Predictors used in

the regression analyses included scale scores from the NEO-FFI (Costa & McCrae, 1992), dichotomized scale and subscale scores from the DASS (Lovibond & Lovibond, 1995b), verbal and non-verbal memory factor scores derived from the WMS-IV (Wechsler, 2009a), age (dichotomized), education (in years), gender and errors on the NART. Outcome variables included GFF scale scores (for multiple linear regression) and a dichotomized global memory complaint measure (for binary logistic regression). Whilst the Likert scale data obtained from the scale scores on the NEO-FFI are, strictly speaking, not of an interval level (see Jamieson, 2004), evidence strongly suggests that such measures are still appropriate for use in a range of statistical tests, including regression models (Carifio & Perla, 2007; Norman, 2010). Therefore, scale scores on the NEO-FFI were considered appropriate for use in the regression analyses in this chapter.

Another issue relating to levels of measurement in multiple linear regression is the possibility of data on the outcome variable being constrained (i.e., limited at either upper or lower values). Whether data on continuous outcome variables is constrained or not can be difficult to determine, although a limited range and/or a strong positive or negative skew can be indicative of data restriction. To evaluate the continuous outcome variable used in the current study, histograms and descriptive statistics were examined. Histograms revealed normal distributions for GFF scores, which ranged from 76 to 207, suggesting a good spread of scores over the scale (which can range from 33 to 231). Thus, the continuous outcome variable used in the current study exhibited little or no evidence of constraint based on these screening methods.

External Variables

In regression models proposing causal influences among variables, the results rest partly on the assumption that no external variables (i.e., variables unaccounted for in the analysis) considerably influence the outcome variable (Field, 2005). This assumption is not of key importance to the current analyses, given the primary objective is to examine the utility of individual predictors rather than the overall quality of any one regression model. Nonetheless, the current study incorporates pertinent contextual variables (i.e., memory performance, age, gender, education and

NART errors) when examining the utility of affective distress as a predictor of memory complaints beyond characteristics of personality. Memory performance, age, education, gender and premorbid intellectual functioning all have the potential to play a role in the complex associations between memory complaints, affective distress and personality. For this reason, these variables were incorporated into all of the regression analyses.

Non-Zero Variance in Predictors

Given correlations between two variables can only be calculated when values on both variables vary to some degree (Field, 2005), both linear and logistic regression require that scores on each predictor variable show some level of variation (i.e., have greater than zero variance). To assess this, descriptive statistics were examined for all predictors prior to conducting any of the regression analyses. All variables obtained variances greater than zero.

Outliers

Univariate. Given the relative sensitivity of continuous variables in linear regression techniques to outliers, the data was initially screened for univariate outliers via z-scores, histograms and boxplots within each of the measures. No z-scores exceeded a value of 3 for the GFF scale, education (years), premorbid intelligence (NART errors), VR factor scores, LM factor scores, or for any of the five measures of personality. Histograms and boxplots also conveyed an absence of outlying scores for each of these measures. Consequently, no action was taken with regard to any of these variables.

Multivariate. Multivariate outliers were assessed via Mahalanobis' distance values calculated on measures of personality, memory complaints, education, premorbid intelligence, VR factor scores and LM factor scores. No case exceeded the critical Chi-square value of 29.59 ($df = 10, p < .001$) and an absence of outliers for each of these variables was supported by boxplots, histograms and outlier identification based on z-score cut-offs (mean ± 3 standard deviations). For this reason, data from all 177 participants who participated in the research was retained for the main analysis.

Linearity

Given multiple linear regression is based on the method of least squares, it is assumed that any relationships between variables included in the regression model are linear. Linearity between variables was assessed simply by observing scatterplots between each pair of variables included in the regression analysis. Scatterplots between all pairs of variables were examined prior to any of the regression analyses to check for linearity. For all pairs of variables included in the multiple linear regression analyses, the associations were clearly linear.

Multicollinearity and Singularity

Multicollinearity and singularity between predictors in a multiple linear regression model are problematic because they (1) limit the size of R^2 , (2) make it difficult to determine which predictors are truly important to the model, and (3) reduce the reliability of regression coefficients for predictors (Field, 2005). Field suggests several methods for assessing multicollinearity and singularity, including correlations between predictor variables as well as variance inflation and tolerance factors. Multicollinearity is generally evident when correlations between predictors exceed .80 (Field, 2005), variance inflation factors exceed 10 (Myers, 1990), or when tolerance levels are below .20 (Menard, 1995).

The strongest association between any of the predictor variables (i.e., NEO-FFI scales, depression group, anxiety group, DASS subscale groups, LM and VR factor scores, age group, education, gender and NART errors) was the correlation between scores on the depression and devaluation of life subscale (Kendall's Tau-B = .704, $p < .001$). However, these variables were examined separately in the current study, so at no point were these variables included as predictors in the same regression analysis. The strongest association between any two predictor variables included in the same regression analysis was between the devaluation of life subscale and the self-deprecation subscale of the DASS (Kendall's Tau-B = .614, $p < .001$). Whilst this represents a strong relationship between these two variables, it was not considered problematic with regard to multicollinearity. Furthermore, variance inflation factors did not exceed 10 nor did tolerance levels fall below .20 for any of the multiple regression analyses. Furthermore, at no point in any of the primary

analyses were these variables forced into the same regression model (how variables were entered into the regression models is addressed later in this chapter).

Residuals

Homoscedasticity. Another assumption of multiple linear regression is that the residuals or degree of error in the model should be approximately even across different predicted values (Field, 2005). Without this, statistics pertaining to the accuracy of the regression model are overestimated at some values of the outcome variable and underestimated at others. This assumption was tested by plotting the standardized residual values against the standardized predicted values derived from each regression model. These values were plotted for each regression analysis prior to interpreting the main results. Homoscedasticity was clearly evident for all regression analyses.

Normality. In addition to residuals or the degree of error in a linear regression model being even across different predicted values, it is also assumed that these residuals are randomly distributed around zero (Field, 2005). This was assessed via a normal probability plot of the standardized residuals for each regression analysis, whereby the plot should show a normal distribution of standardized residuals grouped around zero. Normal distributions of the residuals were obtained for all regression analyses carried out.

Results

The following section details the results of the regression analyses utilized to examine the value of depression and anxiety (and specific features of them) in predicting memory complaints beyond characteristics of personality and within the context of memory performance, age, gender, education and premorbid intelligence. The results are reported first for overall depression status followed by specific depressive symptoms. The analyses examining overall anxiety status are presented next, followed by specific anxiety symptoms. Within the two sections focussing on depressive symptomatology and anxiety symptomatology, predictions of applied memory complaints (GFF scores) using multiple linear regression are presented first, followed by predictions of global memory complaints (high versus low) using binary

logistic regression. Correlations between all variables utilized in the study are reported in Appendix G.

Depressive Symptomatology as a Predictor of Memory Complaints

Applied complaints. To examine overall depression status as a predictor of memory complaints, the current study first employed a four-stage multiple linear regression analysis predicting scores on the GFF scale. In the first stage, depression status (depressed vs. not depressed) was entered into the model. In stage two, neuroticism scale scores were entered given neuroticism is the personality characteristic most consistently reported in the literature to be associated with memory complaints and depression (reviewed in Chapter 3). In stage three, a forward analysis (based on contribution to the R^2 value) was conducted on the remaining personality scales (i.e., extraversion, openness, agreeableness and conscientiousness) to assess whether they too may contribute to GFF scores beyond depression status and neuroticism scale scores. In stage four, a stepwise analysis (again based on their contribution to R^2) was conducted on the contextual variables (i.e., LM and VR factor scores, age group, gender, education and NART errors). A stepwise method was used on the contextual variables in stage four because this is the most practical method for assessing variables in terms of their unique contribution to an outcome variable as well as any effects of suppression on other predictor variables included in the model. For the stepwise analyses used in stage four, variables were only retained in the model if their removal resulted in a significant ($p < .05$) reduction in the R^2 value.

Depression status accounted for a small but significant amount of unique variance in GFF scores in stage one ($r = -.18, p = .016$). When neuroticism scale scores were entered into the model in stage two, they too accounted for a significant amount of unique variance in GFF scores (semi-partial $r = -.334, p < .001$). However, with neuroticism scale scores in the model, depression status no longer accounted for a significant amount of unique variance in GFF scores (semi-partial $r = .00, p = .984$). In stage three, extraversion (semi-partial $r = .24, p = .002$), openness (semi-partial $r = .19, p = .011$) and conscientiousness (semi-partial $r = .19, p = .015$) scale scores all accounted for a significant amount of additional unique

variance in GFF scores and were entered into the model. With these three additional personality measures included in the model, depression status still failed to account for a significant amount of unique variance (semi-partial $r = -.02$, $p = .792$).

Neuroticism scale scores, however, still accounted for a small but significant amount of unique variance (semi-partial $r = -.16$, $p = .035$). In stage four, LM factor scores and education were entered into the model. In this model, neuroticism (semi-partial $r = -.20$, $p = .009$), extraversion (semi-partial $r = .22$, $p = .004$), openness (semi-partial $r = .20$, $p = .010$), conscientiousness (semi-partial $r = .17$, $p = .024$), LM factor scores (semi-partial $r = .23$, $p = .002$) and education (semi-partial $r = -.16$, $p = .040$) all accounted for a significant amount of unique variance in memory complaints, though depression status (semi-partial $r = .03$, $p = .724$) did not. Summary statistics for each model are reported in Table 16.

Table 16

Predicting GFF Scores from Depression, Personality and Contextual Variables

Model	Predictors Included	Variance Accounted For			Increase in Variance Accounted For		
		R^2	F	p	ΔR^2	ΔF	p
1	Dep	.05	8.69	.004	-	-	-
2	Dep, Neu	.14	14.27	<.001	.09	18.94	<.001
3	Dep, Neu, Ext, Open, Con	.28	13.04	<.001	.14	10.61	<.001
4	Dep, Neu, Ext, Open, Con, LM, Edu	.33	11.46	<.001	.05	5.70	.004

Note: Consc = Conscientiousness scale scores, Dep = Depression status, Edu = Education (years), Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores, Open = Openness scale scores.

Given not all variables included in stage four of the model accounted for a significant amount of unique variance in GFF scores, the analysis was re-run with only significant predictors included. In this final model, neuroticism (semi-partial $r = -.21$, $p = .006$), extraversion (semi-partial $r = .22$, $p = .004$), openness (semi-partial $r =$

= .20, $p = .008$) and conscientiousness (semi-partial $r = .18$, $p = .020$) scale scores, as well as LM factor scores (semi-partial $r = .23$, $p = .002$) and education (semi-partial $r = -.16$, $p = .041$) each accounted for a significant amount of variance. The final model accounted for a total of 31.93% of the variance in GFF scores, $F(6, 170) = 13.92$, $p < .001$.

To examine specific features of depression as a predictor of memory complaints, a four-stage multiple linear regression analysis predicting scores on the GFF scale was also used. However, in the first stage, a forward analysis was applied to the presence or absence of symptoms measured by each of the seven depressive subscales of the DASS (dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest, anhedonia and inertia). A subscale was included in the model if its inclusion resulted in a significant increase in the R^2 value. Stages two, three and four were identical to those used to examine overall depression status. That is, neuroticism scale scores were entered in stage two, a forward analysis of the remaining personality variables was conducted in stage three, and a stepwise analysis of the contextual variables was conducted in stage four.

In stage one, anhedonia accounted for a significant amount of variance in GFF scores ($r = -.20$, $p = .007$). No other subscale from the DASS depression scale accounted for a significant amount of unique variance in GFF scores. In stage two, neuroticism accounted for a significant amount of unique variance (semi-partial $r = -.326$, $p < .001$) in GFF scores. However, as with overall depression status, anhedonia failed to account for a significant amount of unique variance in GFF scores with neuroticism scale scores in the model (semi-partial $r = -.05$, $p = .500$). In stage three, extraversion (semi-partial $r = .24$, $p = .002$), openness (semi-partial $r = .19$, $p = .011$) and conscientiousness (semi-partial $r = .18$, $p = .015$) scale scores each accounted for a significant amount of unique variance. With these three additional personality measures in the model, neuroticism scale scores remained a significant predictor of GFF scores (semi-partial $r = -.17$, $p = .025$), though anhedonia still failed to account for a significant amount of unique variance (semi-partial $r = -.02$, $p = .792$). In stage four, LM factor scores (semi-partial $r = .23$, $p = .003$) and education (semi-partial $r = -.16$, $p = .042$) accounted for a significant amount of unique variance in GFF scores,

as did neuroticism (semi-partial $r = -.19, p = .012$), extraversion (semi-partial $r = .22, p = .005$), openness (semi-partial $r = .20, p = .008$) and conscientiousness (semi-partial $r = .18, p = .021$) scale scores. Again, however, anhedonia failed to account for a significant amount of unique variance (semi-partial $r = -.02, p = .841$).

Summary statistics for each model are reported in Table 17. A final regression analysis including only significant predictors in the model was not run because the remaining predictors were the same as those in the final model examining overall depression status.

Table 17

Predicting GFF Scores from Depressive Features, Personality and Contextual Variables

Model	Predictors Included	Variance Accounted For			Increase in Variance Accounted For		
		R^2	F	P	ΔR^2	ΔF	p
1	Anhed	.04	7.47	.007	-	-	-
2	Anhed, Neu	.14	14.50	<.001	.10	20.70	<.001
3	Anhed, Neu, Ext, Open, Con	.27	12.61	<.001	.13	9.87	<.001
4	Anhed, Neu, Ext, Open, Con, LM, Edu	.32	11.33	<.001	.05	6.22	.002

Note: Anhed = Anhedonia, Consc = Conscientiousness scale scores, Edu = Education (years), Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores, Open = Openness scale scores.

Global complaints. To examine overall depression status as a predictor of global, dichotomized (high vs. low) memory complaints, a four-stage binary logistic regression analysis was run. Predictor variables were entered (or not entered) into the model using a similar approach to that used in the multiple linear regressions when predicting GFF scores. In the first stage, depression status (depressed vs. not depressed) was entered into the model using a forced-entry method. In stage two, neuroticism scale scores were entered using a forced-entry method. In stage three, a

forward entry method (based on likelihood ratios) was utilized to determine whether any of the remaining personality variables (i.e., extraversion, openness, agreeableness and conscientiousness) made a significant, unique contribution to the model beyond depression status and neuroticism scale scores. In stage four, a backward entry method (based on changes to the model's log likelihood value) was utilized to determine whether any of the contextual variables (i.e., LM or VR factor scores, age group, gender, education and NART errors) resulted in a significant contribution to the model (either through prediction or suppressor effects on other variables in the model).

In stage one, depression status was a weak but significant predictor of global memory complaint status ($OR = 2.36$, 95% CI [1.07, 5.23], $p = .034$). In stage two, neuroticism scale scores were entered into the model, though neither depression status ($OR = 1.60$, 95% CI [0.65, 3.94], $p = .303$) or neuroticism scale scores ($OR = 1.05$, 95% CI [0.99, 1.10], $p = .070$) were significant predictors of global memory complaint status with both variables in the model. In stage three, only extraversion scale scores reached significance as a predictor of global memory complaint status ($OR = 0.94$, 95% CI [0.88, 0.99], $p = .026$). Depression status ($OR = 1.53$, 95% CI [0.62, 3.82], $p = .358$) and neuroticism scale scores ($OR = 1.02$, 95% CI [0.97, 1.08], $p = .357$) again failed to reach significance. In stage four, LM factor scores were the only contextual variable retained in the model ($OR = 0.62$, 95% CI [0.44, 0.87], $p = .006$). In this model, depression status ($OR = 1.24$, 95% CI [0.49, 3.18], $p = .652$), neuroticism scale scores ($OR = 1.03$, 95% CI [0.98, 1.08], $p = .310$) and extraversion scale scores ($OR = 0.94$, 95% CI [0.89, 1.00], $p = .053$) all failed to reach significance as predictors of global memory complaint status. Summary statistics for each model are reported in Table 18.

A final binary regression analysis was run with only LM factor scores in the model, given it was the only significant predictor of high versus low memory complaint status. As the only predictor included in the model, LM factor scores significantly predicted global memory complaint status ($OR = 0.57$, 95% CI [0.41, 0.80], $p = .001$). The model correctly predicted complaint status (high vs. low) membership 59.89% of the time, Nagelkerke $R^2 = .08$, $\chi^2(1) = 11.55$, $p = .001$.

Table 18

Predicting Global Memory Complaint Status from Depression, Personality and Contextual Variables

Model	Predictors Included	Nagelkerke R^2	Correctly Classified	χ^2	p
1	Dep	.04	56.50%	4.73	.030
2	Dep, Neu	.06	59.89%	8.10	.017
3	Dep, Neu, Ext	.10	61.58%	13.20	.004
4	Dep, Neu, Ext, LM	.15	62.71%	21.10	<.001

Note: Dep = Depression status, Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores.

To examine specific features of depression as a predictor of global, dichotomized (high vs. low) memory complaints beyond personality, a four-stage binary logistic regression analysis was again used. However, rather than entering the depression status variable in stage one, a forward analysis of the seven depression subscales assessed by the DASS (i.e., dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest, anhedonia and inertia) was carried out. A subscale was included in the model if its inclusion resulted in a significant increase in the Nagelkerke R^2 value. Given neuroticism scale scores did not make a significant unique contribution to global memory complaint status in the previous regression analysis, they were not entered using a forced entry method in stage two. Rather, neuroticism scale scores were included in a forward entry method (based on likelihood ratios) in stage two with the remaining measures of personality (extraversion, openness, agreeableness and conscientiousness scale scores). In stage three, a backward method based on log likelihood values was carried out to determine whether any of the contextual variables contributed significantly to the model (either through prediction or suppressor effects on other variables in the model).

In stage one, anhedonia was a significant predictor of global memory complaint status ($OR = 2.17$, 95% CI [1.18, 3.98], $p = .013$). In stage two,

extraversion scale scores contributed significantly to the model ($OR = 0.93$, 95% CI [0.88, 0.98], $p = .011$), though anhedonia no longer made a significant, unique contribution with extraversion scale scores included ($OR = 1.74$, 95% CI [0.92, 3.30], $p = .088$). In stage three, LM factor scores were the only contextual variable retained in the model ($OR = 0.61$, 95% CI [0.43, 0.86], $p = .005$). With LM factor scores in the model, extraversion still contributed significantly to the model ($OR = 0.94$, 95% CI [0.89, 0.99], $p = .030$), though anhedonia did not ($OR = 1.68$, 95% CI [0.87, 3.23], $p = .122$). Summary statistics for each stage of the model are provided in Table 19.

Table 19

Predicting Global Memory Complaint Status from Depressive Features, Personality and Contextual Variables

Model	Predictors Included	Nagelkerke R^2	Correctly Classified	χ^2	p
1	Anh	.05	59.32%	6.30	.012
2	Anh, Ext	.09	61.02%	13.15	.001
3	Anh, Ext, LM	.15	63.84%	21.48	<.001

Note: Anh = Anhedonia, Extra = Extraversion scale scores, LM = Logical Memory factor scores.

A final binary logistic regression analysis was run with only LM factor scores and extraversion scale scores in the model. LM factor scores significantly predicted global memory complaint status ($OR = 0.61$, 95% CI [0.43, 0.85], $p = .004$), as did extraversion scale scores ($OR = 0.93$, 95% CI [0.88, 0.98], $p = .008$). The model correctly predicted complaint status (high vs. low) 64.4% of the time, Nagelkerke $R^2 = .14$, $\chi^2(2) = 19.09$, $p < .001$.

Anxiety Symptomatology as a Predictor of Memory Complaints

Applied complaints. To examine overall anxiety status as a predictor of memory complaints beyond personality, a four-stage multiple linear regression analysis predicting scores on the GFF scale was employed as it was with the multiple linear regression examining overall depression status. Anxiety status (anxious vs. not anxious) was entered into the model in stage one, followed by neuroticism scale

scores in stage two (given the relationship neuroticism exhibits with both memory complaints and anxiety, reviewed in Chapter 3). Stage three consisted of a forward analysis (based on increases in the R^2 value) on the scale scores of the four remaining measures of personality (extraversion, openness, agreeableness and conscientiousness) to examine their value in the prediction of GFF scores beyond anxiety status and neuroticism scale scores. The final stage of the model involved a stepwise analysis of the six contextual variables (LM and VR factor scores, age group, gender, education and NART errors). Again, a stepwise method was used in stage four because it is the best method for assessing variables in terms of their unique contribution to the model as well as their role in suppressing the predictive utility of other predictors in the model. Contextual variables were only retained in the regression model if their removal resulted in a significant ($p < .05$) reduction in the overall R^2 value.

As with the depression data, anxiety status accounted for a small but significant amount of variance in GFF scores in the first stage of the model ($r = -.15$, $p = .049$). Neuroticism scale scores accounted for a significant amount of unique variance in GFF scores in stage two of the model (semi-partial $r = -.35$, $p < .001$), though anxiety status no longer accounted for a significant amount of unique variance in GFF scores with neuroticism in the model (semi-partial $r = .01$, $p = .915$). Extraversion (semi-partial $r = .24$, $p = .002$), openness (semi-partial $r = .19$, $p = .011$) and conscientiousness (semi-partial $r = .19$, $p = .015$) scale scores each accounted for a significant amount of unique variance in GFF scores and were entered into the model in stage three. Neuroticism scale scores also still accounted for a significant amount of unique variance in GFF scores with these additional measures of personality in the model (semi-partial $r = -.17$, $p = .027$), though anxiety status did not (semi-partial $r = -.02$, $p = .842$). In stage four, LM factor scores (semi-partial $r = .23$, $p = .002$) and education (semi-partial $r = -.16$, $p = .042$) were the only contextual variables retained in the model. Neuroticism (semi-partial $r = -.20$, $p = .009$), extraversion (semi-partial $r = .22$, $p = .004$), openness (semi-partial $r = .20$, $p = .009$) and conscientiousness (semi-partial $r = .17$, $p = .023$) scale scores all still accounted for a significant amount of unique variance in this final stage, though anxiety status did not (semi-partial $r = .02$, $p = .826$). Summary statistics are reported

for each model in Table 20. A final regression analysis including only significant predictors in the model was not run because the remaining predictors were the same as those in the multiple linear regression analysis predicting GFF scores from overall depression status.

Table 20

Predicting GFF Scores from Anxiety, Personality and Contextual Variables

Model	Predictors Included	Variance Accounted For			Increase in Variance Accounted For		
		R^2	F	p	ΔR^2	ΔF	p
1	Anx	.02	3.93	.049	-	-	-
2	Anx, Neu	.14	14.24	<.001	.12	24.05	<.001
3	Anx, Neu, Ext, Open, Con	.28	10.76	<.001	.14	7.90	<.001
4	Anx, Neu, Ext, Open, Con, LM, Edu	.32	10.00	<.001	.05	5.86	.003

Note: Anx = Anxiety, Consc = Conscientiousness scale scores, Edu = Education (years), Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores, Open = Openness scale scores.

To examine specific features of anxiety as a predictor of GFF scores, the same four-stage multiple linear regression analysis was used. However, a forward analysis of the presence or absence of symptoms measured by the anxiety subscales on the DASS (i.e., autonomic arousal, skeletal musculature effects, situational anxiety and subjective experience of anxious affect) was carried out in stage one rather than entering overall anxiety status into the model. A subscale was included in the model in stage one if it significantly increased the overall R^2 value. Stages two, three and four were the same as those used to assess the value of specific features of depression beyond personality. Neuroticism scale scores were entered into the model in stage two, a forward analysis of the remaining personality variables was conducted in stage three, and a stepwise analysis of the contextual variables was conducted in stage four.

In stage one of the model, situational anxiety accounted for a significant amount of variance in GFF scores ($r = -.261, p < .001$). In stage two, neuroticism scale scores were entered into the model and accounted for a significant amount of unique variance in GFF scores (semi-partial $r = -.322, p < .001$). With neuroticism in the model, situational anxiety still accounted for a significant amount of unique variance in GFF scores (semi-partial $r = -.17, p = .026$). In stage three, extraversion (semi-partial $r = .21, p = .006$), openness (semi-partial $r = .19, p = .012$) and conscientiousness (semi-partial $r = .20, p = .009$) scale scores all accounted for an additional amount of unique variance in the model. With these additional measures of personality in the model, neuroticism scale scores (semi-partial $r = -.16, p = .035$), but not situational anxiety (semi-partial $r = -.13, p = .086$), remained a significant predictor in the model. In stage four, LM factor scores was the only contextual variable retained in the model (semi-partial $r = .20, p = .007$). With LM factor scores in the model, neuroticism (semi-partial $r = -.16, p = .035$), extraversion (semi-partial $r = .19, p = .011$), openness (semi-partial $r = .16, p = .034$) and conscientiousness (semi-partial $r = .20, p = .008$) scale scores all still accounted for a significant amount of unique variance in GFF scores, though situational anxiety did not (semi-partial $r = -.11, p = .139$). Summary statistics for each model are reported in Table 21.

A final multiple regression analysis was run including only significant predictors in the model. In this final model, neuroticism (semi-partial $r = -.19, p = .014$), extraversion (semi-partial $r = .22, p = .004$), openness (semi-partial $r = .16, p = .033$) and conscientiousness (semi-partial $r = .19, p = .011$) scale scores each accounted for a significant amount of unique variance in GFF scores, as did LM factor scores (semi-partial $r = .21, p = .005$). The final model accounted for a total of 30.24% of the variance in GFF scores, $F(5, 171) = 14.83, p < .001$.

Table 21

Predicting GFF Scores from Anxiety Features, Personality and Contextual Variables

Model	Predictors Included	Variance Accounted For			Increase in Variance Accounted For		
		R^2	F	p	ΔR^2	ΔF	p
1	Sit Anx	.07	12.82	<.001	-	-	-
2	Sit Anx, Neu	.17	17.16	<.001	.10	20.10	<.001
3	Sit Anx, Neu, Ext, Open, Con	.28	13.40	<.001	.12	9.27	<.001
4	Sit Anx, Neu, Ext, Open, Con, LM	.31	12.82	<.001	.03	7.36	.007

Note: Sit Anx = Situational Anxiety, Consc = Conscientiousness scale scores, Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores, Open = Openness scale scores.

Global complaints. To assess anxiety status as a predictor of global (high vs. low) memory complaints, a four-stage binary logistic regression analysis was conducted as it was with overall depression status. Predictors were entered into the model using the same method utilized for the logistic regression analyses examining depression status. In stage one, anxiety status (anxious vs. not anxious) was entered into the model via a forced entry method. Neuroticism scale scores were again entered using a forced-entry method in stage two (given they may interact differently with memory complaints when anxiety status, rather than depression status, is in the model). Stage three involved a forward entry method based on likelihood ratios for scale scores on the four remaining personality measures. In the final stage, a backward method was conducted on the contextual variables to examine their contribution to the model.

In stage one, anxiety status was not a significant predictor of high versus low memory complaint status ($OR = 1.76$, 95% CI [0.75, 4.12], $p = .196$). Given anxiety status was found not to be significantly related to global memory complaints in stage one (or in two, three or four), the remaining stages of the analysis are not reported

here and are instead presented in Appendix H. The final model incorporating only significant predictors of memory complaint status was identical to the binary logistic regression analysis predicting memory complaint status from depressive features.

To examine specific features of anxiety as a predictor of global memory complaints beyond personality, a four-stage binary logistic regression analysis was conducted. In stage one, a forward entry analysis was conducted on the four anxiety symptoms measured by the DASS subscales (autonomic arousal, skeletal musculature effects, situational anxiety and anxious affect). As with the logistic regression analysis examining specific features of depression as predictors of global memory complaint status, specific features of anxiety were included in the model if they resulted in a significant ($p < .05$) increase in the Nagelkerke R^2 value. Neuroticism scale scores were entered into the model in stage two using a forced-entry method. A forward entry analysis (based on likelihood ratios) of extraversion, openness, agreeableness and conscientiousness scale scores was carried out in stage three. Stage four involved a backward analysis of the contextual variables to examine their contribution to the prediction of global memory complaints.

In stage one, situational anxiety was a significant predictor of global memory complaint status ($OR = 1.96$, 95% CI [1.07, 3.58], $p = .029$). In stage two, neuroticism scale scores contributed significantly to the prediction of global memory complaints and were added to the model ($OR = 1.05$, 95% CI [1.00, 1.09], $p = .039$). With neuroticism scale scores in the model, however, situational anxiety was no longer a significant predictor of complaint status ($OR = 1.62$, 95% CI [0.86, 3.05], $p = .137$). Extraversion scale scores were the only additional measure of personality added to the model in stage three ($OR = 0.94$, 95% CI [0.89, 1.00], $p = .043$). With extraversion scale scores in the model, situational anxiety ($OR = 1.42$, 95% CI [0.74, 2.73], $p = .292$) and neuroticism scale scores ($OR = 1.03$, 95% CI [0.98, 1.08], $p = .223$) were no longer significant predictors of global memory complaint status. In stage four, LM factor scores were again the only contextual variable retained in the model ($OR = 0.62$, 95% CI [0.44, 0.87], $p = .006$). With LM factor scores in the model, situational anxiety ($OR = 1.30$, 95% CI [0.66, 2.55], $p = .445$), neuroticism scale scores ($OR = 1.03$, 95% CI [0.98, 1.08], $p = .250$) and extraversion scale scores

($OR = 0.95$, 95% CI [0.89, 1.01], $p = .075$) all failed to contribute significantly to the prediction of global memory complaint status. Summary statistics for each stage of the model are provided in Table 22. Again, a final binary regression analysis including only LM factor scores as a predictor was not conducted given the model would have been identical to that reported for the regression analysis predicting global complaint status from overall depression status.

Table 22

Predicting Memory Complaint Status from Anxiety Features, Personality and Contextual Variables

Model	Predictors Included	Nagelkerke R^2	Correctly Classified	χ^2	p
1	Sit Anx	.04	58.19%	4.82	.028
2	Sit Anx, Neu	.07	60.45%	9.23	.010
3	Sit Anx, Neu, Ext	.10	61.58%	13.45	.004
4	Sit Anx, Neu, Ext, LM	.15	66.10%	21.47	<.001

Note: Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores, Sit Anx = Situational Anxiety.

CHAPTER 8

DISCUSSION

Key Points Addressed in Chapter Eight

- The results suggest that affective distress is not predictive of memory complaints beyond what can already be explained by features of personality.
- The association between memory complaints and affective distress might simply be attributable to personality characteristics that can account well for both.
- How memory complaints and affective distress are related depends on how one conceptualizes the relationship between affective distress and personality. In this chapter, the relationship between affective distress and memory complaints is considered within the range of models reviewed earlier in Chapter 3.
- The results suggest a significant shift may be required with regard to how memory complaint theories view affective distress and memory complaints.
- The results may explain why memory complaints are associated with a subsequent risk of depression, even in healthy older adults, and why otherwise-healthy older adults complaining of memory problems may exhibit an increased risk of subsequent dementia.
- Additional studies will need to replicate these results using different measures of affective distress and personality as well as examine whether the findings generalize to a clinical context.

CHAPTER 8: Discussion

This final chapter brings together the first and second sections of this thesis by discussing the results (detailed in Chapter 7) for the current study (detailed in Chapters 5 and 6) within the context of previous empirical literature and memory complaint theory (reviewed in Chapters 2, 3 and 4). The chapter begins with a detailed synopsis of the results pertaining to the research questions that are listed at the end of Chapter 5. This section begins by examining the association between measures of affective distress (both overall and specific features for depression and anxiety) and memory complaints, beyond features of personality and the contextual variables (Questions 1 and 2). Next, this section discusses the results of the current study pertaining to the impact of how memory complaints are assessed; that is, the result of measuring memory complaints via a global measure or an applied measure (Question 3).

The chapter then shifts its focus to the features of personality and contextual variables that played a role in memory complaints in the current study, either directly or indirectly, and discusses them within the context of relevant literature. The theoretical and clinical implications of the results obtained are then discussed, followed by the limitations of the current study and suggested directions for future research. The thesis then concludes with an overall summary of Section Two, which details the current study, results and implications.

Memory Complaints and Affective Distress

The first and second research questions outlined in Chapter 5 query the extent to which memory complaints made by older adults are associated with overall and specific measures of affective distress (in this case, depression and anxiety) beyond personality characteristics and relevant contextual variables. For the current study, the results examining the association between measures of affective distress and memory complaints uniformly suggest that affective distress is not related to memory complaints in older adulthood beyond features of personality and relevant contextual variables. Indeed, depression status, anxiety status and symptoms of anhedonia and situational anxiety, operationalized via scores on the DASS, all failed to predict memory complaints beyond what could already be accounted for by

relevant features of personality. These results were consistent regardless of the manner in which affective distress and memory complaints were assessed.

When predicting applied memory complaints, overall depression status accounted for a small but significant amount of variance in GFF scores on its own. However, the relationship between overall depression status and memory complaints failed to materialize beyond measures of personality. More specifically, depression status did not contribute significantly to the prediction of GFF scores with neuroticism scale scores in the model. Given the semi-partial correlation for depression status declined almost to zero when neuroticism was entered into the model, little change in its predictive value occurred when the remaining measures of personality and the contextual variables were also entered into the model as well.

The result was virtually identical when predicting applied memory complaints on the GFF scale via specific features of depression. Of the seven features of depression assessed by the DASS, the subscale assessing symptoms of anhedonia (i.e., the loss of positivity or enjoyment in day-to-day life) was found to be the best predictor. As with overall depression status, the presence of symptoms of anhedonia accounted for a small but significant amount of variance in GFF scores. Again, however, when neuroticism was entered into the model, the value of symptoms of anhedonia as a predictor of applied memory complaints decreased almost to zero. As with overall depression status, the semi-partial correlation for anhedonia symptoms changed little when the remaining measures of personality and the contextual variables were entered into the model.

For global complaints of memory problems (i.e., high vs. low), the results again suggested that overall depression status as well as specific features of it contribute little beyond aspects of personality and the contextual variables included in the analysis. Overall depression status was a weak but significant predictor of high versus low memory complaint status. However, with neuroticism also in the model, depression offered little additional predictive value. The odds ratio for depression status showed little change when extraversion scale scores were entered into the model but did drop further with verbal memory in the model.

The final regression analysis for depression also supports the notion that depression contributes little to memory complaints beyond personality and contextual variables. Consistent with the results for situation-specific memory complaints, anhedonia was again found to be the only feature of depression measured by the DASS significantly associated with global memory complaints. Anhedonia was a weak to medium-strength predictor of global memory complaints on its own, though failed to reach significance with measures of personality in the model. Extraversion was found to be the only measure of personality related to global memory complaints in stage two of the model, yet anhedonia failed to reach significance with this measure of personality also in the model. The predictive value of anhedonia declined further when verbal memory scores were entered in stage three.

Thus, in response to research questions one and two, depression (either overall depression status or specific features of it) was found not to be associated with memory complaints (either global or applied) beyond what could already be explained by measures of personality. In all four regression analyses, overall depression status or symptoms of anhedonia were modestly but significantly associated with memory complaints (both applied and global) as the only predictor in the model. However, for three of the four regression analyses, these measures of depression failed to provide any significant additional explanation of memory complaints beyond levels of neuroticism. For the final analysis, where neuroticism was found not to be uniquely associated with global memory complaints, anhedonia still failed to explain memory complaints beyond levels of extraversion. At least for the measures of depression utilized here, the results strongly suggest that affective distress contributes little to memory complaints in older adults beyond what can already be accounted for by measures of personality.

As with depression status, overall anxiety status accounted for a small but significant amount of variance in applied memory complaints measured via the GFF scale. Again, however, the association between anxiety status and memory complaints decreased almost to zero when neuroticism scale scores were entered into the model in stage two. Consistent with the results for overall and specific measures

of depression, the predictive value of overall anxiety status changed little when the remaining personality measures and the contextual variables were entered into the model.

For specific features of anxiety assessed via the DASS, symptoms of situational anxiety were the measure found to be most useful for predicting applied memory complaints measured via the GFF scale. Symptoms of situational anxiety accounted for a small to medium amount of variance in GFF scores; more than that accounted for by overall anxiety status. Whilst overall anxiety status and both measures pertaining to depression (overall status and symptoms of anhedonia) accounted for almost no variance in GFF scores with neuroticism in the model, situational anxiety still accounted for a small but significant amount of variance in applied memory complaints (GFF scores) beyond neuroticism. However, when the remaining personality measures of extraversion, openness and conscientiousness were entered into the model in stage three, situational anxiety also failed to account for a significant amount of unique variance. The strength of the association between memory complaints assessed via the GFF scale and symptoms of situational anxiety decreased further when relevant contextual variables (verbal memory performance and education) were entered in stage four.

For overall anxiety status as a predictor of global memory complaints, affective distress was found not to be significantly associated with complaints, even as a zero-order relationship. Thus, the question of whether anxiety is associated with memory complaints in older adults beyond personality is irrelevant here. Even so, entering features of personality and the pertinent contextual variables into the model in stages two, three and four all reduced the predictive value of overall anxiety status considerably.

For specific measures of anxiety assessed via the DASS subscales, situational anxiety was found to be the most useful (and only significant) predictor of global memory complaints. Situational anxiety was a weak predictor of global memory complaints on its own but again did not reach significance when neuroticism was added to the model. Again, the value of situational anxiety as a predictor of global

memory complaints declined further when additional personality and contextual variables were entered.

Thus, in response to research questions one and two, anxiety (either overall status or specific features of it) was not associated with memory complaints (either global or applied) beyond what could already be explained by personality. Of the four regression analyses pertaining to anxiety, one indicated anxiety failed to predict memory complaints at all, two indicated that measures of anxiety failed to predict memory complaints beyond levels of neuroticism, and one indicated that anxiety failed to predict memory complaints beyond all relevant measures of personality. Contrary to the results for the analyses on depression, symptoms of situational anxiety did account for a significant amount of unique variance in memory complaints assessed via the GFF scale beyond levels of neuroticism, though they offered little value beyond other relevant measures of personality. Coupled with the results obtained for measures of depression, the results strongly suggest that affective distress contributes little to memory complaints in older adults beyond what can already be explained by personality.

Reconsidering the Role of Affective Distress in Memory Complaints

A considerable number of studies have examined the relationship between memory complaints and affective distress (or symptoms of it) in older adult populations. A total of 27 studies examining the association between affective distress and memory complaints in older adulthood were reviewed in Chapter 2. Of these 27 studies, all reported at least one significant association between them, with medium effect sizes typically reported for depression and a range of effect sizes reported for anxiety. To this point, affective distress (particularly depression or depressive symptoms) has arguably been the most consistent predictor of memory complaints in older adulthood identified to date.

Various explanations have been put forward for why affective distress consistently predicts memory complaints. Dux et al. (2008) proposed that negative affect distorts perceptions of one's own memory abilities, such that higher levels of negative affectivity leads to tougher appraisals of our own performance. Alternatively, Slavin et al. (2010) suggested cognitive decline may mediate the

relationship between affective distress and memory complaints. Depression, for example, appears to play a role in some forms of cognitive decline (e.g., Alzheimer's disease), which in turn leads to more frequent or severe complaints of memory problems. However, an earlier study by Jorm et al. (2004) found memory complaints and depression to be associated beyond cognitive abilities, suggesting the relationship is not entirely mediated by cognitive function.

Whilst memory complaints may well be associated with affective distress beyond any mediating role of cognitive function, the results obtained in the current study suggest affective distress and memory complaints might not be directly associated with one another beyond personality. That is, the relationship between memory complaints and affective distress in older adults might not be direct in nature, but rather the consequence of personality characteristics that account well for both. For example, older adults exhibiting higher levels of neuroticism are more likely to experience depression, anxiety or associated symptoms (e.g., Barnhofer & Chittka, 2010; Bienvenu et al., 2007; Kotov et al., 2010; Weber et al., 2011) and more likely to complain of memory problems (e.g., Pearman & Storandt, 2004, 2005). Such associations would engender an indirect relationship between memory complaints and affective distress, without the two necessarily being causally related.

However, the notion that memory complaints in older adults might only be indirectly related to depression and anxiety failed to transpire in an earlier study (Comijs et al., 2002). Comijs et al. incorporated measures of depression, anxiety and neuroticism, finding symptoms of depression and anxiety to be associated with memory complaints, even with a measure of neuroticism also in the model. The contributions of both depressive symptoms ($OR = 1.30$, 95% CIs [1.03, 1.66]) and anxiety symptoms ($OR = 1.38$, 95% CIs [1.09, 1.73]) with a measure of neuroticism in the model were small, but remained significant. However, Comijs et al. incorporated different measures of personality into the analysis (i.e., mastery and perceived self-efficacy), which may not have fully captured the association between affective distress and memory complaints.

The discrepancy between the results of the current study and those of the study by Comijs et al. (2002) may be attributable to a number of factors. It is possible that the use of different measures of affective distress, memory complaints

and personality may partially explain the difference (i.e., whether or not depression was found to be a useful predictor of memory complaints beyond neuroticism). Comijs et al. utilized a Dutch translation of the CES-D (Radloff, 1977) to measure depression, the anxiety subscale of the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) to measure anxiety, a single dichotomous question to assess memory complaints and the Dutch Personality Inventory (Luteijin et al., 1985) to measure neuroticism. Alternatively, the current study utilized the DASS (Lovibond & Lovibond, 1995a), sections of the MFQ (Gilewski et al., 1990; Zelinski et al., 1990), and NEO-FFI (Costa & McCrae, 1992) to measure affective distress, memory complaints and personality, respectively. These measures emphasise slightly different aspects of depression, neuroticism and subjective memory appraisals, which may have contributed to differences between the results reported here and those reported by Comijs et al.

An alternative and perhaps more compelling explanation for the contrasting results obtained in the current study and by Comijs et al. (2002) is that sample characteristics, attributable to the manner in which participants were recruited, may have played a role. In the study by Comijs et al., participants were selected at random from a larger sample of older adults aged 55 to 85 years that were recruited for a large-scale longitudinal project examining well-being and autonomy in the elderly (see also, Kliegel & Zimprich, 2005; Kliegel et al., 2005). In contrast, participants in the current study were recruited via a newspaper advertisement for a study specifically on memory (see Appendix B) and were required to actively seek out the researchers in order to participate. This method of recruitment may have prompted two key differences in the sample used here. Firstly, given involvement in the current study was primarily instigated by the participants, the sample used here may have exhibited fewer or less severe symptoms of depression and anxiety than those utilized in the study by Comijs et al. (given depression and anxiety can be associated with avoidance of situations, loss of interest in activities, and lethargy, see American Psychiatric Association, 2013). Consequently, the study may have included fewer participants with levels of affective distress high enough to instigate memory complaints to the same degree. Secondly, given the advertisement used for recruitment specifically emphasised the topic of memory, the current sample may

also have included a higher proportion of participants with genuine worries about their memory; the consequence of which would be a stronger association between memory complaints and concepts closely associated with worry (i.e., neuroticism).

The fact that different sampling procedures may have contributed to inconsistent results between the current study and those reported by Comijs et al. (2002) should not be viewed as a limitation to the current study. Indeed, given the methods of recruitment utilized in this study and by Comijs et al., participants in the current study may have exhibited greater concern for or interest in their own memory performance than those approached for the study by Comijs et al. Consequently, participants in the current study may more accurately represent the population of community-dwelling older adults who present to health professionals or memory clinics with concerns about their memory.

Given this premise, that community-dwelling older adults who seek professional assistance for problems with their memory (whether warranted or not) complain more as a result of personality than affective distress, the question still remains as to precisely how affective distress, memory complaints and personality are, or are not related to one another. Earlier in Chapter 3 a range of possible explanations for the association between affective distress and personality were reviewed, including the common-cause, predisposition and concomitants models for depression and the vulnerability, scar and pathoplasticity hypotheses for anxiety. Whilst the results obtained in the current study suggest affective distress and memory complaints are not associated with one another beyond characteristics of personality, the precise explanation for why this is the case depends on how one conceptualizes the relationship between affective distress (i.e., depression and anxiety) and personality. Consequently, the following section provides a range of possible explanations for why depression/anxiety and memory complaints may not be related beyond personality in some older adult groups. These explanations are derived directly from the models and hypotheses presented in Chapter 3.

Depression. Three categories of models have been proposed that attempt to account for the association between depression and features of personality. The first group of models (common-cause, continuum spectrum, and precursor) all propose that depression and personality are not causally related (each for a different reason).

The second group of models (predisposition and pathoplasticity) both suggest personality causally influences depression severity. Finally, a third group of models (the concomitants and consequences/scar) propose that depression causally influences the expression of personality. Using the results presented in Chapter 7 and each of these groups of models as a framework, the following section provides a range of possible explanations for how depression, memory complaints and characteristics of personality might be associated with one another.

The common-cause, continuum spectrum and precursor account. The common-cause, continuum spectrum and precursor models all propose that depression and personality do not causally influence one another (Klein et al., 2011). As mentioned in Chapter 2, the common-cause and precursor models propose that depression and personality are associated with one another as a result of shared etiological factors (e.g., a predisposition to negative thinking due to genetic vulnerabilities or learned behaviours). If one is to adopt this viewpoint, then the reason depressive symptoms were found not to be related to memory complaints beyond personality in the current study is most likely the result of overlapping factors that make up depression and personality (primarily neuroticism) that are associated with memory complaints. This perspective is depicted in Figure 3.

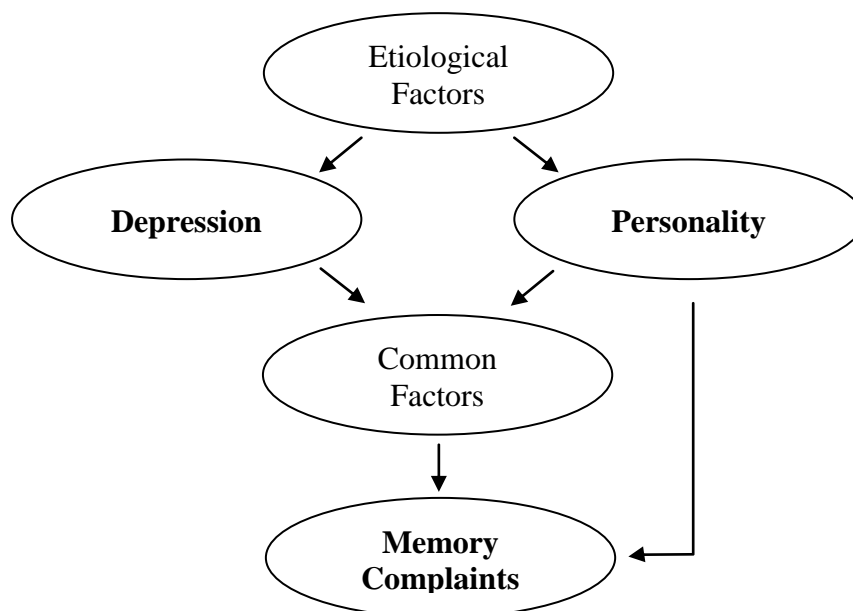


Figure 3. Relationships between memory complaints, depression and personality in the current study, as postulated by the common-cause and precursor models.

Given the features of depression and neuroticism assessed by the DASS (Lovibond & Lovibond, 1995b) and NEO-FFI (Costa & McCrae, 1992), such common factors might include higher-than-normal emotional discomfort, low self-worth and a loss of day-to-day positivity. Given symptoms of anhedonia were found to be the specific feature of depression most closely associated with memory complaints in the current study, and that they did not remain a useful predictor of memory complaints beyond neuroticism (suggesting it was a common factor between depression and personality), the loss of positivity or life satisfaction may play a key role in memory complaints. Whilst it requires further investigation, memory complaints may be more strongly associated with a lack of positive feelings than the presence of negative ones (i.e., positivity may buffer against negative self-appraisals of memory). Also, since features of personality (typically neuroticism) generally remained as a significant predictor of memory complaints with measures of depression already accounted for, one might also assume that neuroticism is a unique predictor of memory complaints beyond the common factors shared with depression (see Figure 3). Such features might include increased feelings of worry, self-consciousness and nervousness.

Alternatively, if one is to adopt the view promoted by the continuum/spectrum model, then a different perspective must be taken with regard to the results obtained in the current study. The continuum/spectrum model proposes that depression and personality are simply different ends of the same spectrum (i.e., current and ongoing reflections of psychological distress). Akin to the state-trait view of psychological distress (Zuckerman, 1983), depressive disorders are viewed as a more temporary, state-like experience of distress and personality features (e.g., neuroticism) as more permanent, trait-like characteristics. Given the results obtained in the current study (i.e., that depressive symptomatology did not significantly predict memory complaints beyond features of personality), proponents of the continuum/spectrum model would argue that memory complaints are associated more with ongoing features of psychological distress (i.e., those tied to personality). Since personality measures in the current study were useful predictors of memory complaints with depression measures already partialled out of the regression model, one could assume that ongoing aspects of psychological distress appear to impact on

memory complaints in a way temporary aspects of distress (e.g., symptoms of depression) do not. Furthermore, the model accounts well for why depression offers little or no additional explanation of memory complaints beyond personality (since they both make up the same spectrum). The manner in which depression and personality were found to be related to memory complaints in the current study, as perceived via the continuum/spectrum model, is presented in Figure 4.

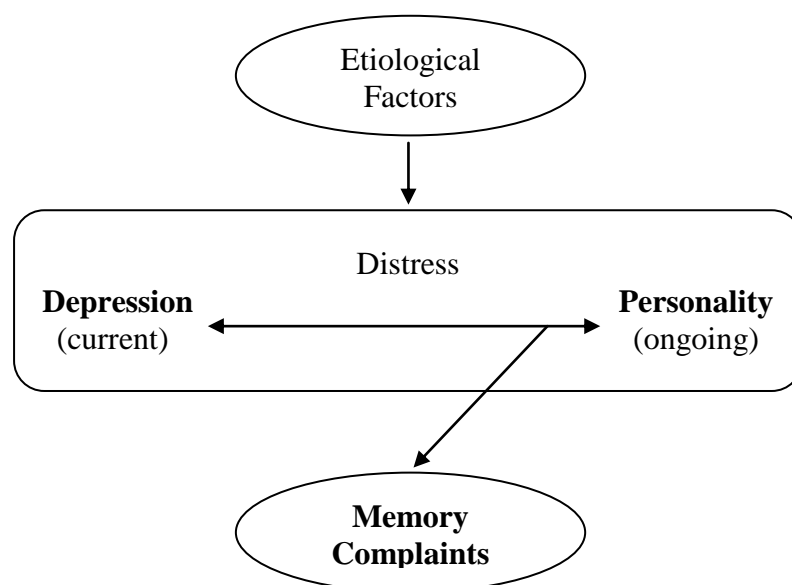


Figure 4. Relationships between memory complaints, depression and personality in the current study, as postulated by the continuum/spectrum model.

The predisposition and pathoplasticity account. Unlike the common-cause, continuum/spectrum and precursor models, the predisposition and pathoplasticity models both propose that personality influences depression (Klein et al., 2011). The predisposition model states that personality impacts on depression status via various mediating factors (e.g., dysfunctional relationships) in addition to the effect of genetic and environmental factors. Alternatively, the pathoplasticity model proposes that personality influences the expression of depression (e.g., its presentation, response to treatment, chronicity and severity), rather than depression itself.

From the perspective of the predisposition model then, the results of the current study can only be interpreted as reflecting the absence of a direct relationship between depression and memory complaints. Given the relationship between

depression and memory complaints diminished almost to zero when personality (primarily neuroticism) was entered into the model, it suggests memory complaints and depression are only associated with one another on account of both being associated (directly or indirectly) with personality. That is, in the same way ice-cream sales and drowning rates are associated with one another on account of changes in weather activity, the predisposition model (along with the current set of results) suggests depression severity and memory complaints are only related via personality. For example, older adults exhibiting higher levels of neuroticism would, on average, exhibit an increased vulnerability to depression (via mediating factors, such as dysfunctional relationships) as well as complain more about their memory. Consequently, depression and memory complaints will shift in unison with one another with fluctuations in neuroticism between participants, without necessarily being directly related to one another. Presumably a range of other factors influence only depression vulnerability or memory complaints as well, and this may account somewhat for the relatively large proportion of unexplained variance in memory complaints beyond depression status. The manner in which the predisposition model can account for the results obtained in the current study is depicted in Figure 5.

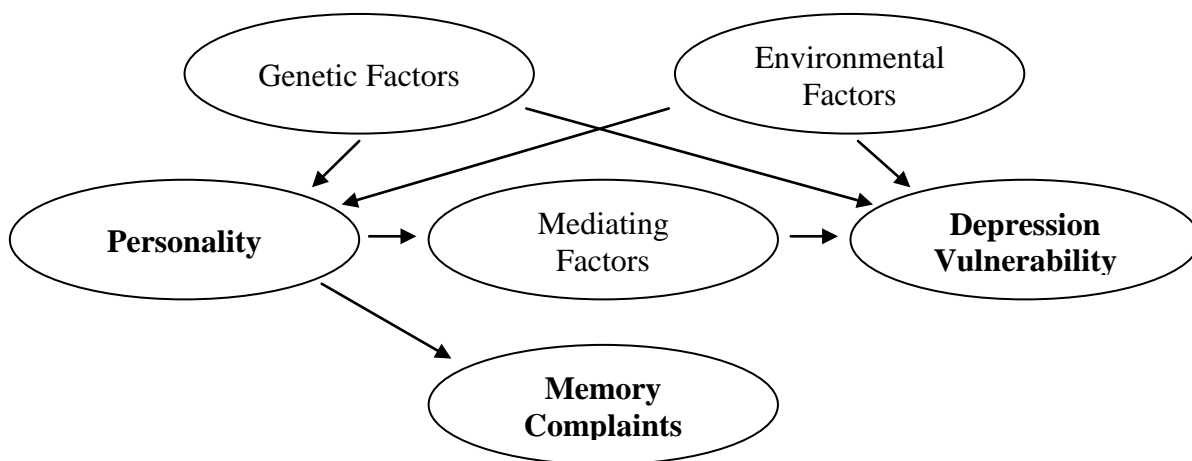


Figure 5. Relationships between memory complaints, depression and personality in the current study, as postulated by the predisposition model.

The pathoplasticity model provides a similar account to the predisposition model for why depression and memory complaints were not found to be associated with one another beyond personality in the current study, with one important difference. If viewing the current set of results through the pathoplasticity model, one must again accept that depression and memory complaints are not causally linked, though the reasoning for this is vastly different to that of the predisposition model. The predisposition model implies that depression is only associated with memory complaints because both are associated (directly or indirectly) with features of personality (particularly neuroticism). However, the pathoplasticity model differs from the predisposition model in that personality is said only to influence how depression presents, not the subjective experience of depression itself (see Figure 6). Thus, the substantial loss of value for depression as a predictor of memory complaints when personality features are entered into the model cannot be accounted for by its relationship with personality (since the pathoplasticity model proposes that no such relationship exists).

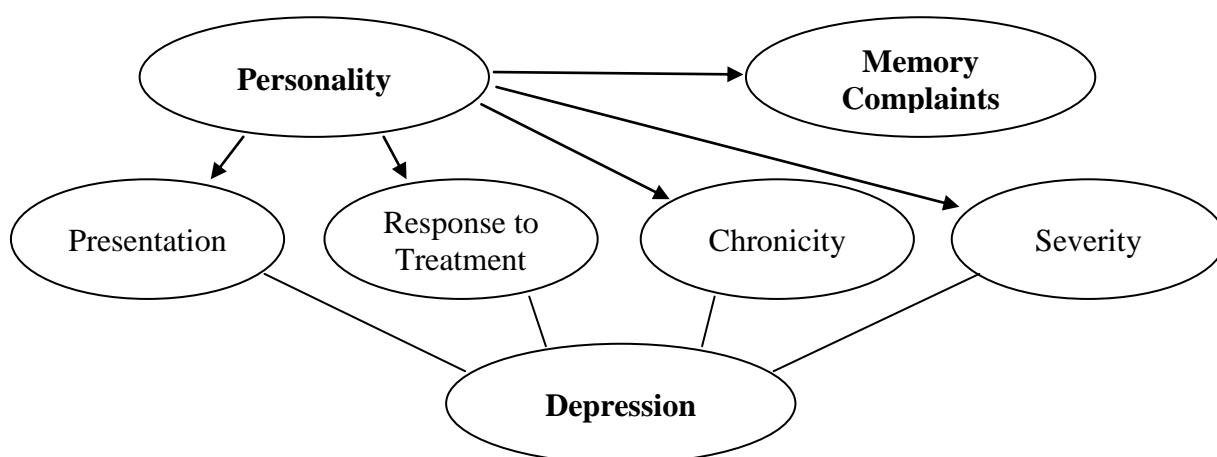


Figure 6. Relationships between memory complaints, depression and personality in the current study, as postulated by the pathoplasticity model.

With regard to the results reported for the current study then, the pathoplasticity model might be seen to suggest that memory complaints are associated only with how depression is expressed, rather than the subjective experience of depression itself. This interpretation would account well for why in

some analyses the relationship between depression and memory complaints also failed to materialize when personality measures besides neuroticism (e.g., extraversion) were added to the model. If one is to accept that depression is an entity distinct from personality (even if we assume they are causally related), then it is possible that features of personality may impact on the expression of depression in different ways without necessarily influencing the risk of experiencing it. For example, higher levels of conscientiousness may serve to minimise the presentation of fatigue (since highly conscientious individuals might put in additional effort to overcome it), despite subjective reports suggesting more severe levels of depression. Either way, whether one assumes that personality impacts directly on depression (predisposition model) or only on how it is expressed (pathoplasticity model), both models could be used to argue that depression is not directly related to memory complaints.

The concomitants and consequences/scar account. The third group of models that attempt to explain the relationship between personality and depression includes the concomitants and consequences/scar models. As with the predisposition and pathoplasticity models, the concomitants and consequences/scar models also hypothesize that a causal relationship exists between personality and depression. However, rather than personality influencing depression or the manner in which it is expressed, this third group of models suggest depression exhibits a causal influence on personality. The concomitants model posits that the presence of depression or associated symptoms alters the presentation of personality characteristics. During periods of poor mental health, personality traits associated with depression (e.g., neuroticism) intensify. According to the concomitants model, these changes are temporary and personality returns to its stable baseline when mental health improves and symptoms of depression subside. Alternatively, the consequences/scar model suggests depression also alters personality, but that these changes are long-lasting, possibly permanent.

Whether the changes to personality resulting from depression are temporary (as specified in the concomitants model) or permanent (as specified in the consequences/scar model) is irrelevant when interpreting the results obtained in the current study. For this reason, the models are not differentiated here. Effectively,

what both models suggest with regard to the results obtained in the current study is that personality mediates the entire relationship between depression and memory complaints. That is, depression alters features of personality, which in turn impact on memory complaints (see Figure 7). If one is to adopt the interpretation offered by the concomitants and consequences/scar models, then a causal relationship between depression and memory complaints (albeit mediated by personality) cannot be ruled out. However, one can rule out the possibility that personality and memory complaints are related only on account of both being influenced by depression, given an association between personality and memory complaints exists beyond the role of depression.

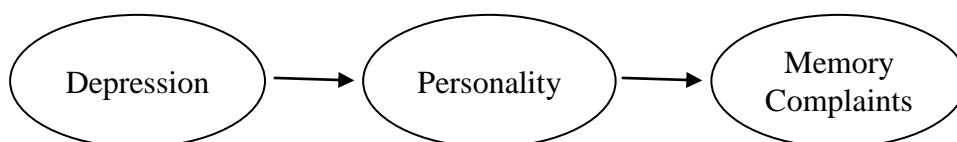


Figure 7. Relationships between memory complaints, depression and personality in the current study, as postulated by the concomitants and consequences/scar models.

In summary, the results of the current study that reflect the relationships between depression, personality and memory complaints can be interpreted in a number of different ways depending on how the association between depression and personality is viewed. Indeed, almost all of the models attempting to account for the relationship between depression and personality offer a different explanation for the results obtained in the current study. If one is to adopt the view offered by the common-cause and precursor models, then the lack of association between memory complaints and depression must result from overlap between causal mechanisms between depression and personality that contribute to memory complaints. From the perspective of the continuum/spectrum model, one could assume that memory complaints are simply associated more strongly with ongoing features of distress (i.e., neurotic tendencies) than temporary features (such as those observed in depressive episodes).

Alternatively, if the predisposition model is adopted, then the current set of results suggest that memory complaints and depression are only associated with one

another on account of their associations with personality (i.e., depression shares no causal relationship with memory complaints). Proponents of the pathoplasticity model, however, would argue that memory complaints are associated only with the expression of depression and not depression itself. Given this reasoning, one must again accept that depression and memory complaints are not directly related. The third group of models, which includes the concomitants and consequences/scar models, does not rule out the possibility of a causal relationship between depression and memory complaints, but does suggest that if such a causal relationship exists, then it is entirely mediated by personality characteristics. Whilst the results of the current study can be conceptualized in a number of different ways, all models can offer an explanation for why depression was found not to be a useful predictor of memory complaints beyond personality in the current study.

Anxiety. In this next section, the four models that attempt to account for the relationship between anxiety and personality (reviewed in Chapter 3) are used as a framework to explain the results relevant to anxiety that are reported in Chapter 7. Whilst the arguments made in models that attempt to explain the relationship between personality and anxiety are conceptually very similar to those used to explain the relationship between personality and depression, they are discussed separately here given the features of anxiety relevant to personality and memory complaints are qualitatively different from the features of depression relevant to personality and memory complaints. Four different hypotheses that attempt to explain the relationship between anxiety and personality have been proposed: the vulnerability hypothesis, the scar hypothesis, the pathoplasty hypothesis, and the common-cause hypothesis. The following section uses each of these hypotheses as a framework to explain the results obtained in the current study pertaining to the relationships between anxiety, personality and memory complaints.

The vulnerability account. The explanation for the relationship between anxiety and personality provided by the vulnerability hypothesis is effectively the same as that used to explain the association between depression and personality in the predisposition model. As its name suggests, the vulnerability hypothesis states that personality characteristics have the potential to put one at an increased risk of affective distress and associated mental health problems (Andersen & Bienvenu,

2011). For example, low levels of extraversion may increase the risk of social phobia, given it may impede participation in social interaction and lead to a preference for seclusion. An explanation of the results obtained in the current study provided by the vulnerability hypothesis is presented in Figure 8.

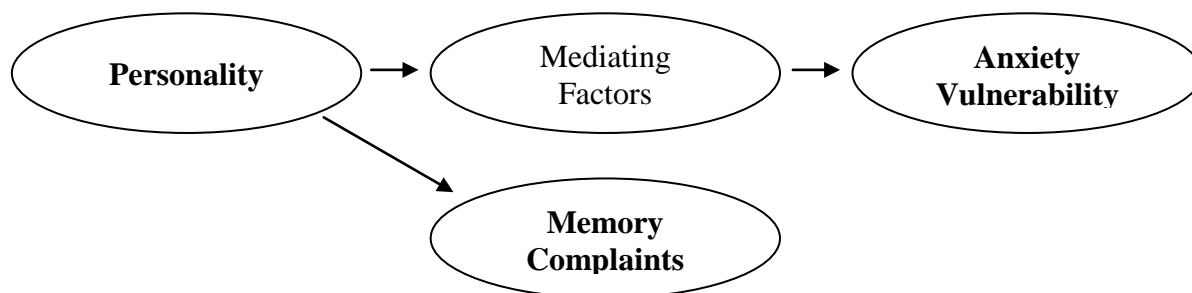


Figure 8. Relationships between memory complaints, anxiety and personality in the current study, as postulated by the vulnerability hypothesis.

As is the case with the predisposition model, the results of the current study can only be interpreted as reflecting the absence of a direct relationship between affective distress and memory complaints when viewed through the vulnerability hypothesis. Given the relationship between anxiety and memory complaints diminished almost completely when personality measures were entered into the model, it suggests that the relationship only exists on account of their association with personality. Of the five measures of personality included in the current study, anxiety was predominantly associated with neuroticism (see Appendix G). Thus, a plausible explanation for the results obtained in the current study based on the vulnerability hypothesis is that higher levels of worry exhibited by participants with elevated levels of neuroticism might contribute to both an increased risk of anxiety and more frequent or severe complaints about memory.

However, whilst this explanation may account for why measures of anxiety typically failed to predict memory complaints beyond personality in most cases, it cannot account for the results obtained with regard to symptoms of situational anxiety. In the current study, the presence of symptoms of situational anxiety remained a significant predictor of memory complaints assessed via GFF scores even with neuroticism scale scores also in the model. Only when the remaining pertinent measures of personality (extraversion, openness and conscientiousness) were entered

into the model did situational anxiety fail to reach significance as a predictor of GFF scores. In this case then, rather than an underlying tendency to worry being the reason for why anxiety failed to predict memory complaints beyond personality, self-confidence (strongly associated with extraversion, see Cheng & Furnham, 2002) and/or a tendency to be self-critical (possibly associated with conscientiousness) may explain the loss of predictive value of anxiety beyond personality. Whatever the case, the results are still consistent with the notion that memory complaints are not related to depression beyond the relationship they exhibit with features of personality.

The scar account. The argument regarding anxiety and personality put forward in the scar hypothesis is analogous to that proposed in the consequences/scar model to account for the relationship between personality and depression. That is, personality and anxiety are said to exhibit a relationship because above-normal levels of anxiety change (or ‘scar’) personality. Where the vulnerability hypothesis would maintain that higher levels of extraversion buffer against social phobia through additional opportunities for habituation, the scar hypothesis would attribute this association to the effect of social phobia on levels of extraversion. That is, continued exposure to the anxiety associated with social phobia would discourage involvement in social activities that is typically reflected in individuals exhibiting high levels of extraversion. The manner in which anxiety, personality and memory complaints are purportedly linked in the scar hypothesis (in combination with the results of the current study) is depicted in Figure 9.

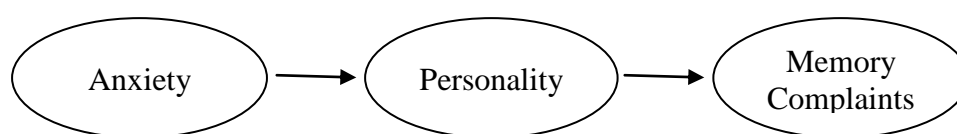


Figure 9. Relationships between memory complaints, anxiety and personality in the current study, as postulated by the scar hypothesis.

For the scar hypothesis, the results obtained in the current study must be interpreted as a reflection of anxiety impacting only on personality (i.e., not directly on memory complaints), which in turn impacts on memory complaints. For all regression analyses but one, anxiety symptoms (whether overall or specific) were

found not to be associated with memory complaints beyond neuroticism. These results likely reflect the notion that anxiety simply constitutes a core component of neuroticism (Jylha & Isometsa, 2006). Thus, anxiety is simply echoed in relevant aspects of personality, leading to more frequent or severe memory complaints.

An exception to this explanation of the current set of results is that symptoms of situational anxiety remained a significant predictor of memory complaints beyond neuroticism. Situational anxiety, as defined by the DASS (Lovibond & Lovibond, 1995a), refers to anxiety pertaining to one or more specific tasks or events. It may be the case then, that the anxiety exhibited in neuroticism that is detected by the NEO-FFI (Costa & McCrae, 1992) is more generalized and that anxiety pertaining to specific situations may usefully predict memory complaints beyond personality. Indeed, there is nothing to discount the possibility that the specific situations in which (some) participants felt situational anxiety were tasks associated with memory (e.g., difficulty recalling the names of newly-met acquaintances). Evidently, this might reflect a specific form of anxiety within memory complaints that is not exhibited in neuroticism measured via the NEO-FFI.

The pathoplasty account. Like the predisposition and pathoplasticity models that attempt to account for the association between personality and depression, the pathoplasty hypothesis suggests that personality and anxiety are not causally related, but indirectly associated with one another via the impact of personality on factors associated with anxiety. For example, extraversion is not a cause or the result of anxiety prompted by social situations. Instead, the pathoplasty hypothesis suggests that extraversion might impact on the likelihood of attending a social situation, but not directly on the subjective experience of anxiety itself. The relationships between anxiety, personality and memory complaints in the current study, as accounted for by the pathoplasty hypothesis, are presented in Figure 10.

With regard to the results obtained in the current study, advocates of the pathoplasty model would argue that anxiety shares no causal relationship with memory complaints (direct or indirect). Rather personality could be seen as influencing the appearance or expression of anxiety, as well as exhibiting a direct influence on memory complaints. The results pertaining to symptoms of situational anxiety again suggest that they may be of some predictive value for memory

complaints beyond levels of neuroticism, though not beyond personality in its entirety.

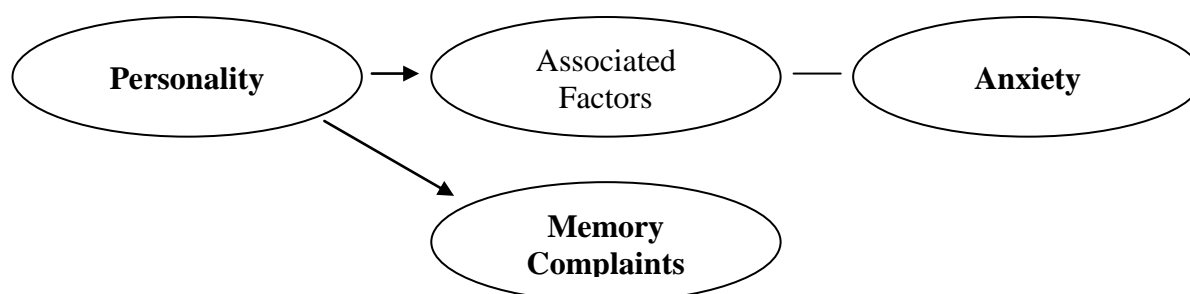


Figure 10. Relationships between memory complaints, anxiety and personality in the current study, as postulated by the pathoplasty hypothesis.

The common-cause account. The final hypothesis discussed here that attempts to account for the relationship between anxiety and personality, and that can be applied to the results in the current study, is the common-cause hypothesis. The explanation offered by the common-cause hypothesis for why anxiety and personality are associated with one another is analogous to that used to explain the relationship between personality and depression (see Figure 3). That is, anxiety and relevant features of personality are said to have a similar set of etiological factors (both genetic and environmental). Consequently, anxiety and some features of personality (e.g., neuroticism and extraversion) are associated, yet exhibit no causal influence on one another. This notion, as well as how this might play a role in memory complaints in older adults, is depicted in Figure 11.

With regard to memory complaints then, the common-cause hypothesis would suggest that anxiety is not a useful predictor of memory complaints beyond personality due to overlap in the factors that are associated with memory complaints. That is, the aspects of anxiety that are useful for predicting memory complaints are also common to personality (predominantly neuroticism). Given the instruments utilized to assess anxiety and personality in the current study, factors relevant to memory complaints that are common to both anxiety and personality might include above normal levels of emotional discomfort as well as feeling tense or nervous. Such factors would likely make anxiety a useful predictor of memory complaints on

its own, but would tend to provide little value if neuroticism was also included in the model.

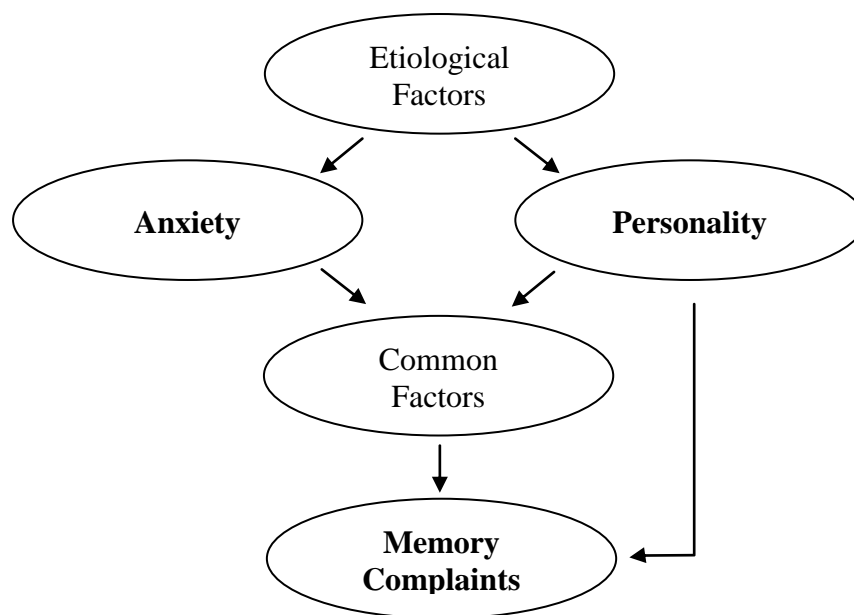


Figure 11. Relationships between memory complaints, anxiety and personality in the current study, as postulated by the common-cause hypothesis.

A hidden variable account. One other possibility that has not yet been considered is the view that one or more variables may underlie all relationships between personality, affective distress and memory complaints. That is, personality, affective distress and memory complaints may not exhibit causal relationships with one another in any direction but rather all share one or more common underlying determinants that forge a relationship between them. Little effort has been directed towards understanding how personality, affective distress and memory complaints interact with one another as a system and so little or no research has investigated whether a hidden variable account might adequately explain the complex associations between them. Such underlying hidden factors might include, for example, features associated with self-esteem, self-confidence or self-concept. Literature suggests self-esteem is associated with memory complaints (Crane et al., 2007; Pearman & Storandt, 2004), affective distress (Sowislo & Orth, 2013) and personality (Erdle, Irwing, Rushton, & Park, 2010; Zeigler-Hill, Besser, Myers,

Southard, & Malkin, 2013), so a hidden variable account will likely explain at least part of the associations between them.

A more likely explanation though (given all models and hypotheses are supported to some degree by the available evidence) is that a rather complex arrangement of direct and indirect influences as well as shared genetic, environmental and underlying hidden factors contributes to the relationships amongst memory complaints, affective distress and personality. One could envisage a scenario whereby genetic and environmental factors contribute to personality and affective distress, which in turn influence each other. In addition, underlying hidden variables such as self-esteem and self-concept (also determined by genetic and environmental factors) influence personality, affective distress and the frequency and severity of memory complaints. Such a model could not only account for the relationships between personality and affective distress (given the extent of shared determinants) but also for the relatively weak associations with memory complaints (given that the model specifies that complaints are spuriously linked to affective distress and personality, and that hidden variables might contribute to personality, affective distress and memory complaints in different ways). Figure 12 depicts this set of relationships.

With regard to the results obtained in the current study, this hidden factors model would suggest that the relationships memory complaints exhibit with affective distress and personality are both spurious and that personality only remains a significant predictor of memory complaints with affective distress already in the model because hidden underlying variables (e.g., self-esteem) are not accounted for. One might also infer that anxiety and depression are not useful predictors of memory complaints in older adults beyond personality simply because aspects of the hidden variables that influence both memory complaints and affective distress also influence both memory complaints and personality. Furthermore, additional features of hidden variables may link memory complaints and personality that are not observed with memory complaints and affective distress (given features of personality are predictive of memory complaints even when affective distress is accounted for).

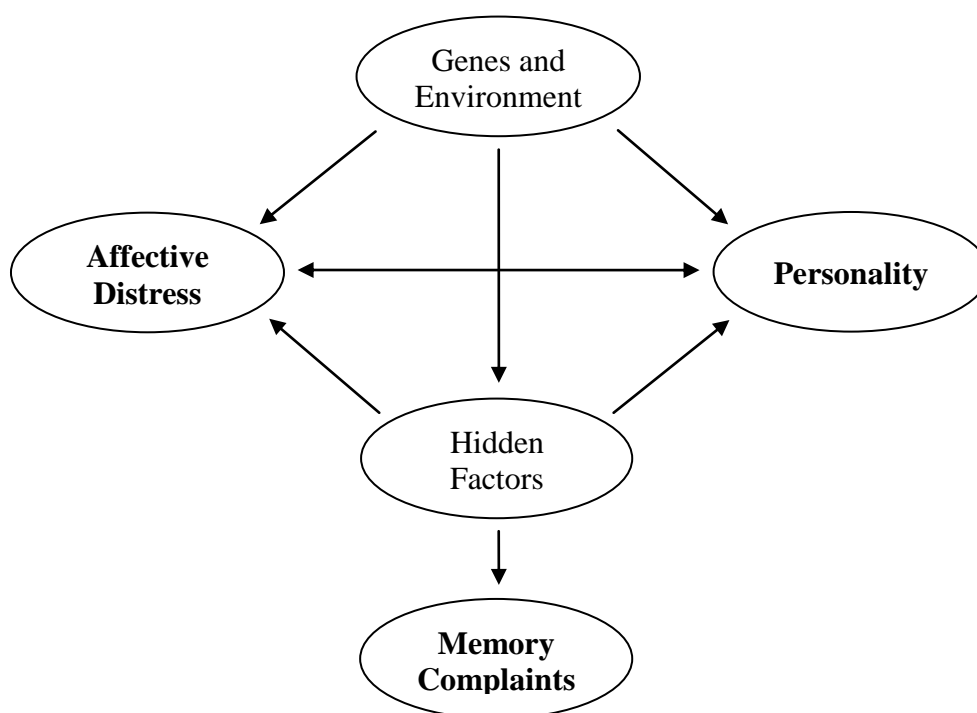


Figure 12. Model linking memory complaints, affective distress and personality via genetic, environmental and underlying hidden factors.

Applied Versus Global Memory Complaints

The third research question addressed by the current study pertains to whether the relationship between affective distress and memory complaints beyond personality differs according to the manner in which memory complaints are assessed. A clear divide exists in the literature regarding how memory complaints are assessed (i.e., globally or applied), though little effort has been invested in systematically investigating the impact of this on associations with affective distress. Research reviewed in Chapter 2 suggests consistent results regardless of how memory complaints are assessed. That is, affective distress typically shares medium-strength relationships with memory complaints irrespective of whether complaints are evaluated globally or in applied settings. However, whether the method for assessing memory complaints remains irrelevant when personality is also incorporated is yet to be examined.

The results of the current study primarily suggest that the manner in which memory complaints are assessed is not an important factor when examining the

relationship between affective distress and memory complaints beyond personality. With the exception of overall anxiety status as a predictor of global memory complaints, all measures of affective distress were found to be related to memory complaints prior to incorporating personality or other relevant variables into the relationship (see Appendix G). Zero-order Pearson correlations between applied memory complaints assessed via the GFF scale and overall depression status ($r = -.18$), anhedonia ($r = -.20$), overall anxiety status ($r = -.15$) and situational anxiety ($r = -.26$) suggest weak to medium-strength relationships between general and specific features of affective distress and memory complaints applied to specific situations (e.g., recalling names or phone numbers). For high versus low memory complaints measured via responses to a single global memory complaint question, Phi coefficients suggest weak associations with overall depression status ($\phi = .16$), anhedonia ($\phi = .19$) and situational anxiety ($\phi = .17$), but no significant relationship with overall anxiety status ($\phi = .10$), despite being in the expected direction.

Given Pearson correlations and Phi coefficients can be interpreted in much the same way when Phi coefficients are calculated for two binary variables (Guildford, 1936), the correlations with the GFF scale and with the dichotomised, high versus low global measure can be compared directly with one another. The results suggest that regardless of whether memory complaints are assessed via applied situations or a single, dichotomised global complaint measure, little difference is exhibited in the relationship between memory complaints and depression (or symptoms of it). However, a small impact may exist when observing relationships with anxiety (and specific symptoms of it). Correlations with memory complaints were almost identical for depression status and anhedonia, regardless of how complaints were assessed. For anxiety, however, the correlations for overall anxiety status and situational anxiety were marginally stronger when complaints were assessed via the GFF scale.

With regard to the relationship between memory complaints and affective distress beyond personality, the manner in which memory complaints were assessed still had little bearing on observed relationships. No measure of affective distress (overall or specific) was found to significantly predict memory complaints (either on the GFF scale or for the dichotomized high vs. low group) beyond all pertinent

features of personality. Situational anxiety was a significant predictor of GFF scores, but not (high vs. low) memory complaint status, beyond neuroticism levels. However, it still failed to reach significance when other measures of personality were entered into the model. Thus, whether complaints were assessed via the GFF scale or a high-low dichotomy had little effect on whether affective distress was found to be associated with complaints beyond personality.

In summary, the findings with regard to research question three suggests that whether memory complaints are assessed via applied or global measures does not drastically influence relationships with affective distress. A non-significant relationship was found between overall anxiety status and the global measure of memory complaint, though the effect size values suggest only a very small difference from the effect size found between overall anxiety status and GFF scores. This result is consistent with the findings reported in Chapter 2, which suggest studies assessing memory complaints via global measures (e.g., Clarnette et al., 2001; Jorm et al., 2004; Jungwirth et al., 2004) have obtained results that are largely consistent with studies that assess memory complaints via applied measures (e.g., Dux et al., 2008; Potter & Hartman, 2006; Potter et al., 2009). The results for the current study further suggest that utilizing different measures of complaint remains unimportant even when considering these relationships within the context of personality.

However, these results may differ depending on the content utilized in applied measures to gauge memory complaints. The GFF scale assesses complaints primarily in the context of normal everyday behaviours such as recalling names, directions, phone numbers and recently read material. Such behaviours would likely be related to affective distress very differently compared to behaviours with a stronger affective component, such as when recall is more pressured (e.g., during public speaking or during performance assessment when applying for a job). The GFF scale touches on some of these behaviours (e.g., losing thread of thought during public speaking), though most questions on the scale have a minimal affective component. For this reason, the conclusion offered here that how memory complaints are assessed is not pertinent to their associations with affective distress

(either alone or in the context of personality) is limited to complaints associated with everyday behaviours that contain minimal affective content.

Features of Personality Pertinent to Memory Complaints

To fully appreciate why affective distress was found not to be a useful predictor of memory complaints (either applied or global) beyond personality in the current study, it is important to address what particular features of personality were pertinent to memory complaints. That is, understanding precisely how personality is associated with memory complaints in older adults may help to clarify its impact on the association between complaints and affective distress. Various researchers have proposed different explanations for why complaints may be associated with personality (e.g., Pearman & Storandt, 2004, 2005; Slavin et al., 2010). Consequently, together with the results of the current study, the following section highlights previous explanations (and offers possible new alternatives) for why the association between affective distress and memory complaints may not exist beyond specific features of personality in some older adult populations.

As reviewed in Chapter 2, some previous studies have promoted the view that anxiety impacts either directly or indirectly on memory complaints (e.g., Dux et al., 2008; Slavin et al., 2010). Slavin et al., for example, suggested that anxiety may not be directly related to memory complaints but rather indirectly associated via memory performance. That is, anxiety may impact adversely on memory performance, which in turn leads to more frequent or severe complaints about memory. Other studies, such as that by Dux et al., have put forward the view that anxiety impacts directly on memory complaints, such that more anxiety simply contributes to more frequent or severe reports of memory problems without being mediated by another variable.

In addition, an earlier study by Pearman and Storandt (2004) proposed that the relationship between memory complaints and neuroticism may be attributable to anxiety, given it forms a core component of neuroticism. In the context of the results obtained in the current study, this might suggest that regardless of how personality and affective distress are related to one another, anxiety as a form of affective distress makes no additional contribution to memory complaints beyond anxiety

associated with levels of neuroticism. Certainly there is no reason (logically or empirically) to assume that anxiety as a form of affective distress is in any way a distinct experience to the anxiety captured by measures of neuroticism, so anxiety may offer no additional predictive value for memory complaints beyond neuroticism simply because of an overlap between symptoms of affective distress and features of personality.

Despite this possibility, neuroticism typically remained a significant predictor of memory complaints beyond anxiety status and anxiety symptoms in the current study, suggesting anxiety alone may not sufficiently explain the association between neuroticism and complaints. Neuroticism encompasses a number of other features in addition to anxiety, including depressive features, self-consciousness and vulnerability to stress (Costa & McCrae, 1992). It is possible that features of depression contribute to memory complaints beyond anxiety, although results from the current study suggest neuroticism typically remains a significant predictor of memory complaints beyond depression status and associated features as well. An increased vulnerability to stress is certainly associated with both anxiety and depression as defined by the American Psychiatric Association in the DSM-5 (American Psychiatric Association, 2013), although self-consciousness need not be. Thus, one possibility is that feelings of self-consciousness associated with neuroticism, in addition to anxiety, contribute to memory complaints in older adulthood and that this is the reason neuroticism remains a significant predictor of complaints beyond affective distress.

The idea that self-consciousness contributes to memory complaints in addition to anxiety was supported in a follow-up study by Pearman and Storandt (2005). The study reported that self-consciousness (a facet of neuroticism that was assessed via the NEO PI, Costa & McCrae, 1992) remained a significant predictor of memory complaints (assessed via the Memory Assessment Clinic's Self-Rating Scale, Crook & Larrabee, 1992), even when a measure of anxiety (also assessed via the NEO PI) was also included. In addition, the measure of anxiety also remained a significant predictor of complaints. Thus, the results support the notion that anxiety, as well as additional facets of neuroticism (i.e., self-consciousness), both make unique contributions to memory complaints. These unique contributions emerged

even after accounting for a specific feature of conscientiousness (self-discipline), self-esteem and objective memory performance assessed via the Logical Memory subtest of the WMS-III (Wechsler, 1997).

Whilst neuroticism remained an important predictor of memory complaints across most of the analyses conducted in this study, it was not a significant unique predictor of complaints when predicting global (high vs. low) memory complaint status. There are two likely explanations for why this might be the case. Firstly, given the relationship is in the expected direction, failure to reach significance may simply be attributable to a lack of statistical power on account of weak associations that are often observed between variables in this literature. Given the complexity of memory complaints and the number of factors that likely influence them, using more general measures of complaints (i.e., removing situation or scenario specificity) may simply ‘water down’ these associations even further. In the same way that specific features of neuroticism can be a better predictor of memory complaints than overall measures neuroticism (Pearman & Storandt, 2005), complaints pertaining to specific situations may be more strongly tied to personality and affective distress than general complaints.

Alternatively, it is also possible that memory complaints assessed within a given situation more readily trigger thoughts and feelings associated with neuroticism (or specific features of it, such as anxiety or self-consciousness) than do memory complaints assessed more generally. Perhaps memory complaints assessed in a particular context (e.g., public speaking) or in relation to specific behaviours (e.g., reading) provide a stronger cue for past experiences during which feelings associated with neuroticism (e.g., anxiety or self-consciousness) were felt. It is certainly possible that global complaints may tap into more general cognitive appraisals of one’s own abilities and that applied complaints may more closely reflect past experiences that contribute to these general appraisals. Further study would certainly help to clarify this.

As with previous studies (e.g., Pearman & Storandt, 2004, 2005), the results obtained in the current study also found conscientiousness to be a useful predictor of memory complaints when complaints are assessed via applied settings (both earlier studies used sections of the Memory Assessment Clinic’s Self-Rating Scale, Crook

& Larrabee, 1992). Conscientiousness reflects a combination of a range of different tendencies, including being organized, methodical, disciplined, efficient, neat and careful (Pearman & Storandt, 2005; Thompson, 2008). Pearman and Storandt (2005) found self-discipline to be an important predictor of memory complaints in applied settings but also stated that there is no clear, logical explanation for the association. Indeed, their results suggest the relationship is not mediated by memory performance (whereby self-discipline might improve memory performance, which in turn might lower complaints). One possibility not entertained by Pearman and Storandt is that self-discipline may foster positive self-esteem (and vice versa), which may in turn improve evaluations of oneself (including memory).

Whilst the results reported here support earlier research that indicates conscientiousness is related to applied memory complaint measures, the current study found conscientiousness not to be a useful predictor of memory complaints when assessed via a single global complaint question. Regardless of which measure of affective distress was included in the model (depression status, anxiety status, anhedonia or situational anxiety), conscientiousness was not found to be a significant unique predictor of high versus low global memory complaint status. This result was consistent across all regression analyses.

In addition to clear differences in how conscientiousness is related to applied versus global complaints (with regard to statistical significance) in the context of other variables included in this study, clear differences can also be seen when examining zero-order relationships. Without considering the influence of other variables, conscientiousness shared a much stronger association with applied memory complaints assessed via the GFF scale ($r = .34, p < .001$) than with memory complaints assessed via a global complaint measure ($r = -.12, p > .05$). Whilst this was also the case for the remaining measures of personality used in the current study, this was not the case for the associations between memory complaints and memory performance, which showed little difference in their associations (see Appendix G). Therefore, whilst the weaker association with global memory complaints may in part be attributable to global complaints providing a less reliable or valid measure, it is certainly also possible that conscientiousness (like neuroticism) asserts more

influence on complaints when judgements on one's own performance are made in a specific context or with regard to specific behaviours.

For the current study, a third feature of personality found to be as important as (if not more important than) neuroticism and conscientiousness in the context of memory complaints, was extraversion. Evidence regarding the relationship between memory complaints and extraversion in previous research is mixed (cf. Jorm et al., 2004; Perrig-Chiello, Perrig, & Stahelin, 2000; Ramakers et al., 2009; Vestberg, Passant, Risberg, & Elfgrén, 2007), though there has been little or no evidence for a contribution of extraversion to memory complaints beyond other pertinent measures of personality, affective distress and cognitive function.

Extraversion, like conscientiousness, is comprised of features and behaviours that on face value would not logically exhibit an influence on memory complaints. Extraversion is characterised by talkativeness and a tendency to be outgoing and energetic (Thompson, 2008). One possibility, however, is that higher levels of extraversion are predictive of a more active lifestyle in older adulthood. Recent evidence suggests that a more active lifestyle assists with maintaining cognitive function (Paillard-Borg, Fratiglioni, Xu, Winblad, & Wang, 2012; Sofi et al., 2011), which in turn may reduce complaints about memory. Another possibility is that a third variable or group of variables underlie this relationship. Self-esteem, for example, is associated with both measures of extraversion (e.g., Robins, Tracy, Trzesniewski, Potter, & Gosling, 2001) and memory complaints (e.g., Crane et al., 2007). Consistent with the hidden variable account discussed earlier, the relationship between extraversion and memory complaints may be partly or entirely explained by their relationship with other variables, such as self-esteem and self-confidence.

A fourth feature of personality that also demonstrated some value in predicting memory complaints in the current study was openness. Openness to experience captures a wide variety of behavioural patterns but it is perhaps best characterized by a tendency to be creative, intellectually minded, intelligent, and to approach things with a philosophical disposition (Thompson, 2008). Openness to experience is associated with greater intelligence, which may be reflected in greater memory performance (and consequently, fewer or less severe memory complaints). Apart from these distant connections, however, there is little justification for

examining openness within the context of memory complaints. Possibly for this reason, there is little evidence available regarding its relevance to memory complaints in older adulthood in previous research. Vestberg et al. (2007) reported that openness was of little use for differentiating between those with and without objective memory impairment but there is little or no evidence examining the role of openness to experience in memory complaints in healthy older adult populations.

In the current study, openness to experience accounted for a significant amount of unique variance in memory complaints assessed via the GFF scale, regardless of the measure of affective distress being examined. Its unique contribution to the models predicting GFF scores was small but consistent (partial correlations were typically around .20). In addition, the zero-order correlation between openness to experience and GFF scores ($r = .21, p < .01$, see Appendix G) suggested a small to medium-strength association between them. In contrast, openness to experience exhibited almost no predictive value and no zero-order association with memory complaints assessed globally. For all four models predicting global memory complaint status, openness to experience failed to reach significance. In addition, the zero-order correlation between them also suggests little or no association ($r = -.01, p < .05$, see Appendix G). Again, the discrepancy in how openness to experience is related to applied and global complaints may be attributable to how effectively the different measures capture the notion of memory complaints, or it may be reflective of personality features asserting more influence on complaints when they are assessed in a specific context.

Why openness to experience shared an association with applied memory complaints in the current study is less clear. It is conceivable that intelligence (which was associated with openness to experience, see Appendix G) might contribute to greater memory performance and therefore reduce complaints about memory. However, it is unlikely that this small contribution would have persisted beyond the introduction of (years of) education into the model (given education is also strongly associated with intelligence, see Matarazzo & Herman, 1984). Including years of education in two of the models made little difference to the unique contribution of openness, suggesting openness to experience might be associated with memory complaints via a path other than one that involves intelligence.

Another possibility is that the association between openness to experience and applied memory complaints is also attributable to one or more hidden variables, such as self-confidence. Lack of self-confidence might hamper openness (via a need to avoid potentially shameful experiences), whilst also leading to less favourable evaluations of one's own memory abilities. This explanation, however, does not account for the absence of a relationship between openness to experience and global memory complaints (which logically should be subject to self-confidence as well). Perhaps memory complaints assessed in the context of specific situations are more sensitive to attributes like self-confidence. Further research on the association between openness to experience and memory complaints is required, firstly with regard to whether the association continues to materialize, and if so, why it exists. Such research would benefit from a more detailed evaluation of openness, such as that provided by the NEO-PI (Costa & McCrae, 1985) or NEO PI-R (Costa & McCrae, 1992).

The final feature of personality incorporated into the current study, which demonstrated little or no value in predicting memory complaints beyond other variables included in the study, was agreeableness. Agreeableness was not found to be a significant predictor of either applied or global memory complaints in any of the multiple regression models. However, it did exhibit small to medium-strength zero-order relationships with both applied ($r = .22, p < .01$) and global ($r = -.16, p < .05$) memory complaints. The most likely explanation for why agreeableness failed to predict memory complaints in the regression models is that it exhibited small to medium-strength correlations with neuroticism ($r = -.22, p < .01$), extraversion ($r = .24, p < .01$) and conscientiousness ($r = .19, p < .05$). Thus, any small contribution to the prediction of memory complaints that agreeableness may have been able to make was likely already accounted for by other measures of personality previously entered into the model.

In summary then, several features of personality contributed to memory complaints measured both in an applied context and more globally. Consistent with previous literature (Pearman & Storandt, 2004, 2005; Slavin et al., 2010), neuroticism was a useful predictor of memory complaints assessed in applied settings. Neuroticism did not, however, uniquely contribute to the prediction of a

global memory complaint measure, which may be partly attributable to such complaints failing to adequately tap into previous experiences that triggered feelings associated with neuroticism (e.g., anxiety or self-consciousness). As with neuroticism, conscientiousness played a role in applied memory complaints but also failed to uniquely contribute to global memory complaints. Again, this may be partly attributable to global complaints failing to activate memories of previous experiences associated with conscientiousness.

Contrary to expectation, (higher) extraversion uniquely predicted (lower) memory complaints across more of the regression models than both neuroticism and conscientiousness. Extraversion was a significant predictor of applied memory complaints across all models, regardless of the measures of affective distress, personality and contextual variables also included. It was also a significant predictor of global memory complaints in models that included overall anxiety status and anhedonia. However, only LM factor scores predicted global memory complaints beyond overall depression status and situational anxiety. Whilst evidence for the role of extraversion in memory complaints is mixed, a hidden variable account that includes self-esteem or self-confidence may partly explain the relationship between them.

Another feature of personality found to be a useful predictor of (higher) memory complaints in the current study was (lower levels of) openness to experience. Unlike extraversion, openness to experience was only predictive of applied memory complaints assessed via the GFF scale. Partial correlations indicated a relatively small contribution of openness to GFF scores, although significance testing indicated a consistent unique contribution. The underlying reason openness to experience exhibits an association with applied memory complaints is still not clear. However, one possible explanation is that memory complaints assessed in the context of specific situations are more sensitive to attributes like self-confidence. As a result, lower self-confidence might lead to more frequent or severe complaints of memory (in applied settings) as well as reduced openness to experience (in an attempt to avoid any potentially distressing or shameful experiences).

The final measure of personality utilized in the current study, agreeableness, was the only feature of personality that failed to uniquely contribute to memory

complaints in any of the regression models. This may be largely attributable to overlap with other features of personality included in the analyses, given significant zero-order correlations were found between agreeableness and both applied and global memory complaints. Across all analyses undertaken in the current study, one rational explanation for why neuroticism, extraversion, openness to experience and conscientiousness were found to be associated with memory complaints (mostly in an applied context), is that one or more underlying variables contributes to all of them. Self-esteem or self-consciousness, for example, may exhibit an influence on various aspects of personality as well as memory complaints, which may contribute to the associations observed in the current study (and, indeed, in previous studies).

Contextual Variables Pertinent to Memory Complaints

Results regarding the role of the contextual variables in the regression models were, for the most part, very consistent. Of the six contextual variables incorporated into the current study (i.e., age, gender, education, premorbid intelligence, verbal memory performance and non-verbal memory performance), age, gender, premorbid intelligence and non-verbal memory performance played little or no role in predicting memory complaints, or in suppressing the relationship between memory complaints and measures of affective distress and personality. Alternatively, education was found to play a minor role in memory complaints, and verbal memory performance was found to be the most prominent contributor across all predictors included in the study.

Whilst there is little consensus regarding whether or not verbal memory performance is related to memory complaints (cf. Dux et al., 2008; Mendes et al., 2008), results from the current study indicated that LM factor scores were the best predictor of memory complaints across every analysis, regardless of how memory complaints were assessed. In addition, LM factor scores were the only significant predictor of global memory complaints when overall depression status or situational anxiety was included as the measure of affective distress. Whilst neuroticism, extraversion and conscientiousness all exhibited stronger zero-order correlations with applied memory complaints than verbal memory performance, the overlap between measures of affective distress and personality (see Appendix G) likely contributed to LM factors scores being the prominent predictor. Then again, LM

factor scores exhibited a stronger association with global memory complaints than any measure of affective distress or personality. As mentioned earlier, this may be at least partly attributable to specific scenarios or behaviours in applied memory complaint measures being more likely to cue past experiences tied to affective distress or features of personality.

Alternatively, non-verbal memory performance was found not to be a significant predictor of either applied or global memory complaints. Zero-order correlations between VR factor scores and both applied and global memory complaints were in the expected direction, but also failed to reach significance. However, the discrepancy between verbal and non-verbal measures of memory in how well they predicted memory complaints in the current study likely does not solely reflect genuine differences in how different types of memory are related to memory complaints. Rather, verbal memory was most likely found to be a better predictor of applied memory complaints than non-verbal memory due to the content included in the GFF scale. The GFF scale includes two sections that assess subjective complaints pertaining to recall of written material in books, newspapers and magazines, so it is perhaps not surprising that the GFF scale correlates more strongly with recall for verbal information than for recall of line drawings.

However, verbal memory performance was significantly related to global memory complaints, whilst non-verbal memory performance was not. Given the manner in which global memory complaints were measured in the current study was content neutral (i.e., “How would you rate your memory in terms of the kinds of problems you have?”), this likely reflects the notion that older adults have a greater tendency to recall verbal memory problems than non-verbal memory problems. This may simply be attributable to such problems being more noticeable or occurring more frequently. For example, older adults frequently report problems with recalling names or items on a list (e.g., Amariglio et al., 2011) and such difficulties may carry considerable weight when making global judgements about one’s own memory.

Consistent with earlier research (Bassett & Folstein, 1993; Gagnon et al., 1994; Jonker et al., 1996; Schofield et al., 1997), education also played a small role in predicting memory complaints in some of the regression models. For models predicting GFF scores that incorporated overall depression status or overall anxiety

status, partial correlations for education were both $-.16$ (both $p < .05$), suggesting greater frequency or severity of memory complaints for those with less education. However, zero-order correlations indicated little or no relationship between them, suggesting other variables in the regression models might suppress the relationship between education and memory complaints.

The remaining contextual variables (i.e., age, gender and premorbid intelligence) appeared to play little or no role in predicting memory complaints in the regression models. Age and premorbid intelligence exhibited little or no relationship with memory complaints, regardless of how complaints were assessed (see Appendix G). Whilst both age and premorbid intelligence have the potential to suppress the relationship between memory complaints and memory performance (see Merema, Speelman, Kaczmarek, & Foster, 2012, shown in Appendix A), this did not occur in the current set of regression analyses. This is likely attributable to this suppressor effect being relatively small and to the inclusion of a range of other variables, which either counteract or themselves account for this suppressor effect. Education, for example, was correlated with premorbid intelligence, and age with openness to experience (see Appendix G), which may have distorted this suppressor effect.

As with age and premorbid intelligence, gender played no role in the regression models predicting memory complaints. Gender exhibited a weak association with applied memory complaints, whereby males exhibited more frequent or severe complaints of memory problems (which may be partly attributable to small gender differences in LM factor scores). No significant association was observed between gender and global memory complaints, although the relationship was in the same direction as that observed with applied memory complaints. Whilst some research has found gender to play a role in memory complaints (see Derouesne et al., 1999; Jonker, Geerlings, & Schmand, 2000), the current results suggest that this role may not exist beyond memory performance, features of affective distress and personality.

Theoretical Implications

In both empirical literature and the small number of available models detailing memory complaints and their predictors, it is typically assumed that

affective distress (usually depression) exhibits a direct influence on memory complaints. However, whilst depression is associated with pessimism (Sha, 2006) and low self-esteem (Sowislo & Orth, 2013), there are few features of clinically-diagnosed depression (American Psychiatric Association, 2013) that should logically be directly associated with more frequent or severe complaints of memory problems. Depressed mood, irritability, loss of interest or pleasure, weight change, sleep disturbance, changes to daily activities, fatigue, guilt, difficulties concentrating or suicidality should not exhibit much of a direct influence on memory complaints. Feelings of worthlessness may exhibit a direct influence, though there has been little or no empirical research performed to assess this. Sleep disturbance, loss of interest, fatigue and difficulties concentrating may exhibit an indirect influence via their impact on memory performance, but a direct link between depression and memory complaints is somewhat questionable, given the criteria it is composed of and the lack of evidence linking specific facets of depression to complaints.

Whilst further research is required to establish the precise nature of the relationship between affective distress and memory complaints in the context of personality, the consistency of the results found in the current study suggest that affective distress and memory complaints may not be directly related. If continued research efforts continue to support the findings reported here (that affective distress is not predictive of memory complaints beyond personality), it will require a significant shift in how memory complaint theories conceptualize the relationship between affective distress and memory complaints. In addition, it will require a shift in how this relationship is viewed and interpreted in empirical research, both in past and future studies.

The MSE framework (Berry, 1999) proposes a direct relationship between physiological arousal or mood state and self-evaluations of one's own memory performance. For example, experiences of anxiety (e.g., increased heart rate) are interpreted as a vulnerability to poor performance, which consequently negatively affect self-evaluations. Likewise, negative mood states associated with depression are seen as impacting on memory complaints because they distort one's perception of their own abilities. In the context of the results obtained in the current study, the MSE framework overlooks the role of personality and the possibility that

physiological arousal, mood states or affective distress might be related to memory complaints as a result of underlying factors such as self-confidence or self-esteem. Whilst this notion is not central to the purpose of the MSE framework, it presents itself as a serious limitation with regard to how accurately and comprehensively the framework is able to account for and predict memory self-evaluations.

Similarly, the Social Support Model (Chan et al., 2007) also suggests mood (specifically depression) is associated with memory complaints. The model was developed primarily to predict and promote further study on the chronological associations between social support, depression and complaints. The results of the current study do not directly contradict the assertions made by the Social Support Model. That is, despite the fact that features of personality or more fundamental components of self-concept may be largely responsible for the association between depression and memory complaints, the results of the current study do not preclude a relationship between depression and memory complaints; they simply suggest it may be indirect in nature. Thus, if it is indeed found to be the case that affective distress is not associated with memory complaints beyond personality, it will render the Social Support Model somewhat insufficient for accounting for the depression-memory complaints relationship. Personality as an alternative explanation for the associations between social support, depression and memory complaints needs to be examined in order for the Social Support Model to maintain its accuracy and completeness.

The Mediation Model (Crane et al., 2007) takes a slightly different approach to the MSE framework and the Social Support Model in that it was designed primarily to clarify the nature of the relationship between depression and memory complaints. The Mediation Model, although it offers a slightly different interpretation, is somewhat consistent with the results obtained in the current study. The Mediation Model suggests that depression and memory complaints are not directly related, but rather connected through negative cognitive bias (Crane et al., 2007), such that the negative cognitive bias often observed in depression, and not the depression itself, increases memory complaints. This may be the case, though given the results obtained in the current study, further research is required to rule out the possibility that an underlying concept like self-esteem might be responsible for the

relationships proposed in the Mediation Model. That is, perhaps self-esteem is responsible for the associations between depression, negative cognitive bias and memory complaints but is more closely tied to negative cognitive bias.

Consequently, any aspect of self-esteem that plays a role in the association between depression and memory complaints might be quashed when negative cognitive bias is entered into the model. Thus, the notion that negative cognitive bias appears to mediate the relationship between depression and memory complaints could also be accounted for by the hidden influence of self-esteem (or a range variables).

Niederehe's (1998) CDM is the only model to incorporate both affective state (e.g., depression) and personality traits (e.g., neuroticism) as distinct entities that contribute to memory complaints. The CDM proposes that personality traits influence memory complaints directly as well as indirectly via its influence on affective states. Likewise, affective states are said to exhibit an influence on memory complaints directly as well as indirectly via their influence on memory performance. In essence, the CDM adopts the same views as the predisposition and pathosplasticity models (Klein et al., 2011) or the vulnerability hypothesis (Andersen & Bienvenu, 2011), given it endorses the view that personality influences affective states but not the reverse. Whilst there is considerable evidence for this and other viewpoints (see Chapter 3, Personality and Affective Distress), the model at least formally acknowledges the role of personality as distinct from the role of affective distress.

In the context of the current study, Niederehe's (1998) CDM would propose that personality should be associated with memory complaints beyond affective distress (which it was), and that affective distress should be associated with memory complaints beyond both personality and memory performance (which it was not). Whilst further research is required to confirm the absence of a relationship between affective distress and memory complaints beyond personality, the results obtained in the current study are inconsistent with the CDM in that they suggest no direct relationship between affective distress and complaints. It could be argued that the association between affective distress and memory complaints is direct, but that this entire association stems from the influence of personality features (given their inclusion in the model reduced the predictive value of all measures of affective

distress almost to zero). However, even if this is found to be the case, it suggests little need for including affective distress as a predictor, given it provides no additional explanation.

Whilst the results from the current study were unanimous with regard to affective distress and personality, and clear recommendations with regard to relevant theory are possible, it is also worth commenting on the limitations of theory pertaining to memory complaints more generally and the extent to which theory can play a role in the literature. There is evidence in the literature that depression, anxiety, specific features of personality, and memory performance are all predictive of memory complaints (see Chapters 2 and 3). However, many of the relationships that are reported are typically not very strong and are likely highly dependent on what measures are utilized in the research and the characteristics of the sample (including how participants are recruited).

For example, different results were obtained in the current study with regard to whether or not personality predicted memory complaints depending on whether complaints were conceptualized on a continuum in applied settings or as a more global, high-low dichotomy. Despite being one of the more reliable predictors of memory complaints, neuroticism was found to significantly predict applied memory complaints, but not global memory complaints, across all of the regression models. As mentioned earlier, this may be attributable to applied measures of complaints more readily cueing previous experiences associated with neuroticism. Regardless of why this occurred, it demonstrates very well the fragility of relationships in this research area, which presents as a severe limitation to theory development. That is, if seemingly pertinent relationships are dependent on how concepts are measured, it is difficult to imagine how a reliable theoretical framework might develop.

In addition, sample characteristics also have the potential to play a role in memory complaint studies. Indeed, an earlier study by Kliegel, Zimprich and Eschen (2005) reported different results regarding the role of depression in overall cognitive complaints beyond neuroticism depending on the type of sample. The study reported that depression remained a useful predictor of cognitive complaints beyond neuroticism (in fact, it was a better predictor than neuroticism) for a sample of healthy older adults. Alternatively, for participants with age-associated cognitive

decline (AACD), depression was not found to be a useful predictor of cognitive complaints beyond neuroticism. This may be attributable to AACD participants exhibiting more worry (a key component of neuroticism) because of observed cognitive decline, both of which may increase complaints. Likewise, participants in the current study were recruited via advertisements pertaining specifically to memory, which may also have attracted more worried or neurotic individuals. In Kliegel et al.'s study, however, healthy older adults were recruited for research into more general aspects of aging, which may explain why neuroticism was not found to be the strongest predictor.

Thus, it seems likely that relationships that surface within memory complaint research may be sensitive to differences in how relevant variables are conceptualized or on what type of sample the research is based. An unfortunate consequence of this instability is that any theory pertaining to memory complaints is likely to be applicable only under a specific set of circumstances or in a specific context. As a result, theoretical frameworks relating to memory complaints can likely offer little with regard to guiding future research or understanding memory complaints on a more general level (i.e., outside of specific populations or across research that conceptualizes variables differently). This may partly explain the slow rate at which theory in this area has developed as well as why existing theories have failed to garner much support.

Clinical Implications

If it is the case that the results reported in the current study can be replicated and that they generalize beyond the measures utilized here, then there are two important clinical implications for older adult populations. Firstly, in addition to earlier suggestions that memory complaints in older adults should prompt health professionals to screen for mental health problems (see Harwood et al., 2004), the current results may explain why older adults complaining of memory problems may exhibit an ongoing risk of depression, even if it is not present at the time the complaint is made. Secondly, the results may also help to further explain why otherwise-healthy older adults complaining of memory problems exhibit an increased risk of subsequent dementia (see Geerlings et al., 1999; St John & Montgomery, 2002; Tobiansky, Blizard, Livingston, & Mann, 1995; Wang et al.,

2004), despite the absence of cognitive dysfunction at the time the complaint was made.

Whilst memory complaints in older adults are clearly associated with the presence of depression or symptoms of it (see Chapter 2), research also suggests memory complaints are associated with an increased risk of subsequent depression, even in healthy older adults (Tobiansky et al., 1995). Whilst it is difficult to conceive of why memory complaints might precede a later diagnosis of depression in healthy older adults, the results of the current study provide some indication of why this might be the case. Indeed, given memory complaints may be tied to more long-term aspects of personality rather than more transient periods of affective distress, it may be the case that older adults who complain more about memory problems might exhibit personality characteristics that maintain a higher risk of a diagnosis of depression or anxiety across older adulthood. Thus, features of personality might increase complaints (and the risk of mental health issues) at one time point, but also increase the risk of mental health issues at later time points as well. Consequently, memory complaints in older adults may warrant screening for mental health problems both at the time of the complaint, but also at later time points as well. Given prevention of mental health problems is preferable to treating them, memory complaints may be a particularly valuable screening method for older adult populations. However, the extent to which they are useful for identifying subsequent mental health problems requires further study.

In addition, the current results also provide further explanation as to why memory complaints appear to be predictive of a subsequent dementia diagnosis, even if cognitive functioning presents as normal at the time the complaint is made. There is now ample evidence that the presence of depressive symptoms increases the risk of a diagnosis of dementia in later-life (e.g., Barnes et al., 2012; Byers, Covinsky, Barnes, & Yaffe, 2012; Byers & Yaffe, 2011). Paradoxically then, the fact that memory complaints predict subsequent dementia may be totally unrelated to an ability to detect some level of preclinical cognitive decline. Instead, this relationship between complaints and a subsequent diagnosis of dementia may, in some cases at least, be a function of depressive symptoms (which coincide with memory complaints) increasing risk of dementia. Then again, the pathophysiological changes

associated with dementia are thought to begin many years prior to the symptoms of a formal diagnosis of dementia becoming apparent (Sperling et al., 2011). It may be the case that such pathophysiological changes impact on memory performance (which then influence memory complaints), even if the impact of such changes cannot be detected by clinical testing. Thus, additional research is necessary to support a connection between memory complaints, depression and dementia, independent of actual memory dysfunction.

A recent meta-analytic review by Low, Harrison and Lackersteen (2013) examining whether features of personality are predictive of subsequent dementia offers support for this explanation. The meta-analysis examined the associations between the Big Five personality traits and risk of a subsequent diagnosis of dementia in 12 longitudinal studies and three case-control studies. The results of the meta-analysis suggest that whilst extraversion and agreeableness were not linked to subsequent dementia status, neuroticism increased the risk of dementia and both conscientiousness and openness protected against it. Whilst it is possible that one or more factors may underlie the association between personality and a subsequent dementia diagnosis, it can also be understood within the context of the predisposition or pathosplasticity models for depression. That is, specific personality features may increase or decrease the risk of subsequent mental health problems (including depression), which in turn may increase or decrease the risk of a dementia diagnosis. Furthermore, personality features may also increase the likelihood of a memory complaint being made, thus creating an indirect relationship between complaints and a later diagnosis of both depression and dementia. This set of relationships is depicted in Figure 13.

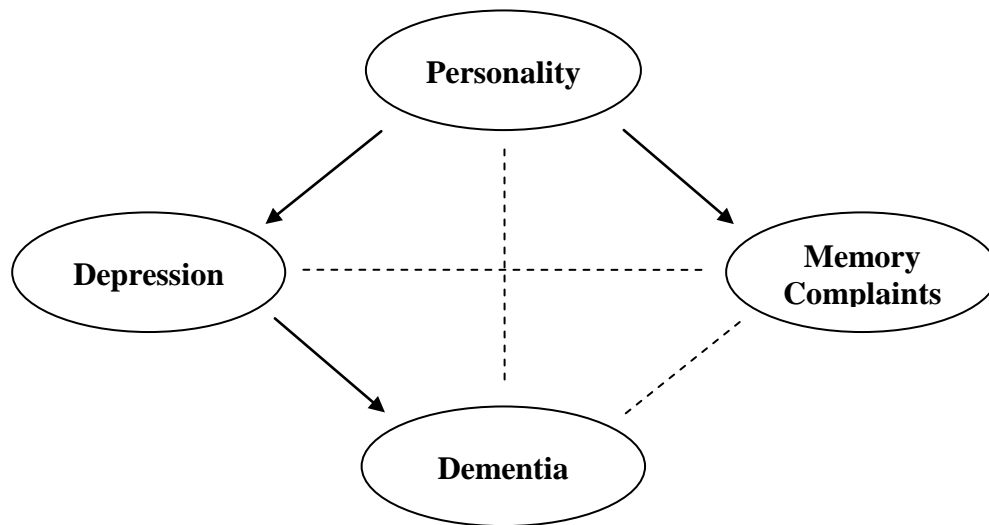


Figure 13. Model linking personality, memory complaints, depression and dementia (derived from the current results and the predisposition and pathoplasticity models). Solid lines represent direct relationships, whilst broken lines represent indirect associations.

Limitations

Whilst the results of the current study have some important implications for healthy ageing in older adulthood, these need to be considered within the context of a few limitations. Firstly, whilst personality and affective distress were treated as separate concepts in the current study (and are treated separately by most models in the literature), it is possible that affective distress influenced reporting on measures of personality. For example, participants experiencing a greater number or more severe symptoms of depression may have reported higher levels of neuroticism, not because it characterizes their personality but because symptoms of depression may simply influence reporting. Thus, the finding that affective distress did not contribute to memory complaints beyond measures of personality in older adults should be viewed with this in mind. Perhaps affective distress failed to contribute to memory complaints beyond personality because its value as a predictor was already expressed through its impact on reporting for personality measures. It is difficult to conceptualize how one might go about dealing with this issue in future, although

observing the expression of personality at different time points (and hopefully under different levels of affective distress) may offer some insight.

Another limitation of the current study pertains to the sample and the manner in which the participants were recruited. For the current study, participants responded to an advertisement for a study on memory placed in a local newspaper. Therefore, given participants were required to seek out the researchers, rather than being selected from a general pool of participants, it is unlikely that many participants in the current study exhibited symptoms of affective distress severe enough to warrant a formal diagnosis of a mood disorder or an anxiety disorder (DASS scores in the current study also supported this). Consequently, the notion that memory complaints might offer a clinically-useful screening tool for subsequent mental health problems in older adult populations needs to be examined in clinical populations. Certainly this sampling method may account for why some previous studies have found aspects of mental health to be useful predictors of cognitive complaints beyond personality (Kliegel & Zimprich, 2005; Kliegel et al., 2005; Pearman & Storandt, 2004), given such previous studies have generally contacted potential participants, rather than the other way around. However, participants who are required to seek out researchers in order to participate in a study are probably more representative of community-dwelling adults likely to present to memory clinics or mental health professionals in primary health-care settings with complaints of memory problems. Indeed, it may be the case that affective distress increases memory complaints in older adults but reduces the likelihood of them being reported.

It should also be noted that the current study deviated from normal testing procedures for the WMS-IV when gathering data from participants. When a full WMS-IV battery is administered, standard testing procedures involve administering the Verbal Paired Associates subtest between the immediate and delayed components of the VR and LM subtests. However, this subtest was substituted with the MFQ, NEO-FFI and DASS questionnaires in the current study. Whilst care was taken to maintain the same time delay as that used in standard testing procedures (i.e., 20-30 minutes), differences in task difficulty and content between completing the questionnaires and completing the Verbal Paired Associates subtest may have

impacted performance on the delayed components of the VR and LM subtests. Consequently, the scale scores presented in Table 14 for the delayed components of the VR and LM subtests may not be an accurate reflection of the overall mean performance of the sample. However, this change in testing procedures likely impacted little on the main conclusions drawn from the results of the current study, given how this data was treated in the analysis.

One final issue to be considered in the context of memory complaint research more generally is the matter of skewed data on measures of affective distress. For all measures of affective distress in the current study, raw scores exhibited a strong positive skew (such that a large proportion of participants showed little or no sign of distress). This was dealt with in the current study by grouping participants into high or low levels of distress on the basis of clinical cut-offs in the DASS (for overall measures of affective distress) or simply as the presence or absence of symptoms (for subscale measures). Whilst treating the data in this manner makes it more amenable to a multiple regression analysis, it likely does not correct for the loss of strength in relationships between variables that results from using skewed data (Dunlap et al., 1995). In contrast, most measures of personality (including the NEO-FFI) are typically designed for use in non-clinical populations, and so do not encounter the same problems with skew that measures of affective distress often do. Consequently, this should be taken into account when comparing affective distress and personality as predictors of memory complaints. The issue of skewed data in measures of affective distress could be managed more effectively in future by utilizing measures of affect that range from extreme positive to extreme negative, rather than simply assessing negative affect.

Future Research

The results of the current study suggest a substantial shift is required with regard to how memory complaints are considered to be related to affective distress in older adults. For nearly 25 years, the relationship between affective distress (including depression and anxiety) and memory complaints in older adults has been conceptualized as being direct in nature. However, in the first study specifically designed to examine whether two measures of affective distress (i.e., depression and anxiety) contribute to memory complaints beyond measures of personality, the

results presented here suggest that neither depression nor anxiety directly contribute to memory complaints in older adults beyond features of personality. Given the substantial shift in thinking with regard to how the relationship between affective distress and memory complaints in older adults would need to be conceptualized (based on the current results), future studies must attempt to replicate the results presented here.

Furthermore, additional research should attempt to replicate these results using other measures of affective distress and personality. Whilst the NEO-FFI and DASS are both reliable and valid measures of personality and affective distress, respectively, it may be the case that the DASS scales are particularly sensitive to aspects of personality or that the NEO-FFI scales are particularly sensitive to levels of affective distress. Thus, to accept that affective distress does not directly contribute to memory complaints beyond personality, it is necessary to observe whether the results of the current study can be reproduced with different measures. Other measures of affective distress that could be utilized include Beck's (1987; 1988) scales, Hamilton's (1960; Maier, Buller, Philipp, & Heuser, 1988a) scales, or the CES-D (Radloff, 1977). For personality, one could utilize the EPQ-R (Eysenck & Eysenck, 1991), the Minnesota Multiphasic Personality Inventory (Butcher et al., 1989), or the NEO-PI-R (Costa & McCrae, 1992).

A second issue that needs to be addressed in the literature is whether the results of the current study generalize to a clinical context. That is, do clinical levels of depression and anxiety contribute directly to memory complaints, or can this relationship also be explained by features of personality, as it was with the measures of affective distress utilized here? Also, if there is a direct relationship between clinical levels of affective distress and memory complaints, does it persist across all anxiety and mood disorder diagnoses? Theoretically, this is an important question given it may further complicate the already-complex and frail theoretical frameworks to an extent that renders them meaningless.

Likewise, it is also important from a clinical perspective given memory complaints may offer a viable screening method for groups at risk of experiencing subsequent and clinically-significant levels of depression or anxiety in older adulthood. This is an important topic given the ageing population and link identified

between late-life depression and dementia. This could be investigated via longitudinal studies that assess the association between the presence or severity of memory complaints at one time point and mental health problems at later time points. This could be achieved by assessing memory complaints in healthy older adults and then intermittently screening for mental health problems (e.g., mood disorders or anxiety disorders) as time passes.

Another question to be answered by additional studies is whether or not the results obtained in the current study generalize beyond the age group assessed here. That is, if follow-up studies do in fact support the notion that affective distress is not directly related to memory complaints beyond features of personality, does this finding extend to younger age groups as well? Clinically, this may be of considerable importance, given memory complaints may offer a screening tool for subsequent mental health problems across the age spectrum. However, this is a distant prospect given additional research first needs to examine how well memory complaints predict subsequent mental health problems.

One final issue within the memory complaint literature that has received little attention is the question of whether positive aspects of mood alleviate complaints, in addition to negative aspects of mood exacerbating them. When focussing on the role of affect in memory complaints, the literature typically examines the presence of affective distress (e.g., the presence of depression or symptoms of it). Whilst the level of distress experienced as a result of mental health problems has been found to be a consistent predictor of memory complaints (see Chapter 2), little is known about whether positive aspects of mood alleviate complaints, in addition to negative aspects of mood exacerbating them. Examining both the positive and negative aspects of mood as a predictor of memory complaints in older adults would also alleviate problems with non-normal data that is typically observed when assessing levels of affective distress in community-dwelling older adults.

SECTION TWO SUMMARY

Section one of this thesis outlined relevant empirical and theoretical literature that was used as a framework for the current study detailed in section two. Section two began with Chapter 5 outlining the rationale, objectives and research questions for the current study. In Chapter 6, the methodology for the research was discussed, followed by the analyses and results in Chapter 7, and the discussion pertaining to these results in Chapter 8.

The key objective examined by the study detailed in this thesis was whether affective distress plays a role in memory complaints in older adulthood beyond what can already be explained by features of personality. This was achieved by assessing the predictive value of overall and specific measures of both depressive symptoms and anxiety symptoms towards memory complaints beyond what could already be accounted for by the Big Five personality characteristics. Furthermore, the current study also examined this topic across both applied and global measures of memory complaints. In addition, this study examined the role of affective distress in memory complaints beyond personality within the context of memory performance, age, education, gender and premorbid intelligence. At the conclusion of Chapter 5, the research questions for the current study were outlined. Possible benefits of the current study were also outlined in Chapter 5, and included improved interpretation of prior empirical studies and theoretical frameworks as well as a possible contribution to mental health screening in older adulthood.

To achieve the objectives set out in this thesis, the current study collected data from community-dwelling older adults between the ages of 65 and 90 years. The sample included participants with little or no problems with vision, hearing, memory and language who had not previously undergone any formal assessment for memory functioning. A total of 177 older adults participated in the study and a correlational approach was used to examine concurrent associations between memory complaints, affective distress, personality, memory performance, age, gender, education and premorbid intellectual function. Participants were assessed individually within their own homes, which typically took around 90-100 minutes to complete.

To examine affective distress as a predictor of memory complaints assessed via the GFF scale and a global complaint status (generated via responses to the first question on the GFF scale) within the context of memory performance, age, gender, education and premorbid intelligence, multiple linear and binary logistic regressions were conducted. For these regression analyses, all measures of affective distress (overall and specific) significantly predicted both measures of memory complaints (situation-specific and global), with the exception of overall anxiety status when predicting global memory complaint status. Despite the measures of affective distress almost unanimously predicting memory complaints, no measure of affective distress (overall or specific) significantly predicted memory complaints (assessed via the GFF scale or via a global complaint) beyond relevant features of personality.

Thus, the results of the current study strongly suggest that affective distress is not related to memory complaints beyond relevant features of personality. One possible interpretation of the results obtained in the current study is that memory complaints and affective distress exhibit an association with one another simply because both are associated with personality. That is, relevant features of personality have the potential to increase both complaints about memory and risk of affective distress. Consequently, memory complaints and affective distress exhibit a spurious relationship whereby they are correlated with one another but not causally related. However, the precise manner in which affective distress and memory complaints are related depends on the position one takes with regard to how affective distress is associated with personality (a range of models detailing this relationship were discussed in Chapter 3).

Regardless of the exact nature of the relationship between affective distress and memory complaints, the lack of association beyond personality characteristics indicates that a significant shift may be required in how this relationship is viewed, should additional studies continue to support the results obtained here. Furthermore, the results obtained in the current study may help to explain why otherwise-healthy older adults exhibit a subsequent risk of depression. Indeed, the relatively stable personality characteristics that increase the likelihood of a memory complaint being made may also put older adults at risk of depression (both at the time of the complaint and subsequently). For this same reason, the results of the current study

may also shed light on why healthy older adults complaining of memory problems also exhibit an increased risk of dementia. Given research continues to support the notion that late-life depression contributes to dementia onset, memory complaints may signal the presence of certain personality characteristics that put older adults at an increased risk of depression, and thus, dementia. However, further empirical studies will need to support the results obtained here using a range of measures for affective distress and personality. Furthermore, it is not yet known whether the results of the current study generalize to a clinical context.

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Appendix A

Published Journal Articles Based on the Thesis Data

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Age and premorbid intelligence suppress complaint–performance congruency in raw score measures of memory

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ABSTRACT

Background: We aimed to examine the role of age and premorbid intelligence (IQ) in suppressing the relationship between subjective memory complaints (SMCs) and raw score memory performance.

Methods: We used a community sample of older adults aged 66–90 years ($N = 121$) to test whether the inclusion of age and a premorbid IQ measure in multiple regression analyses increased semipartial correlations of raw score memory performance in predicting SMCs. Rank contrast correlations were also carried out to observe how age and premorbid IQ are related to complaint–performance congruency. Measures utilized in the study included the Memory Functioning Questionnaire (for SMCs), Visual Reproduction and Logical Memory Subtests (memory performance), and the National Adult Reading Test (premorbid IQ).

Results: Inclusion of age and premorbid IQ in the multiple regression analyses increased semipartial correlations for all raw score measures of memory. Both age and premorbid IQ were significantly related to complaint–performance congruency, whereby older participants and those with lower premorbid IQ scores rated their memory abilities more leniently than younger and higher premorbid IQ participants.

Conclusion: The results suggest differences in age and premorbid IQ play a small role in suppressing the relationship between SMCs and memory performance when utilizing raw score measures of memory.

Key words: subjective memory complaint, older adults, classical suppression, suppressor variable, visual memory, verbal memory

Introduction

The relationship between subjective memory complaints (SMCs) and memory performance has been of considerable interest to researchers over the past 30 years. The interest generated in this relationship is not surprising given the important role SMCs could play in the early identification of memory problems associated with Alzheimer's disease and other dementias. However, it is often found that little or no relationship exists between SMCs and memory performance on objective tests (e.g. Schmidt *et al.*, 2001; Minett *et al.*, 2008). Instead, it is frequently reported that memory complaints are more indicative of psychological

distress (e.g. Zandi, 2004; Potter *et al.*, 2009) or aspects of personality (Pearman and Storandt, 2004; 2005).

The literature suggests that depression in particular is often found to be a prominent predictor of SMCs (e.g. Levy-Cushman and Abeles, 1998; Jorm *et al.*, 2001). Jorm *et al.* (2001) report that while memory complaints do appear to precede future memory decline, they are more often reflective of the presence of negative affect (particularly depression). Anxiety has also been reported to play a role in people's beliefs about their own memory functioning (Stein *et al.*, 1983; Jorm *et al.*, 2001), whereby greater levels of anxiety are associated with reports of more memory problems. Potter *et al.* (2009) also recently demonstrated that SMCs are associated with stress. In a study of 54 female older adults, Potter *et al.* found stress to be significantly associated with SMCs, even after variance associated with symptoms of depression and anxiety was removed.

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While it is not surprising that affect might play a central role in determining the severity of SMCs, the typically weak relationship found between memory complaints and memory performance is somewhat intriguing. One issue that has received little attention in the literature is the possibility that this relationship may be restrained somewhat by one or more suppressor variables. Maassen and Bakker (2001) discuss three types of suppressor variables, of which one might play a role in mediating the relationship between SMCs and performance on objective tests of memory. A “classical” suppressor in a regression analysis is a predictor variable related to another predictor variable but not to the outcome variable. Given obvious differences between the actions of judging one’s own memory performance and recalling, for example, episodic information over relatively short periods of time, it is perhaps not surprising that a number of variables might be associated with one and not the other. Two variables in the literature that appear to fit this definition of classical suppression in the context of memory complaint–performance congruency are age and premorbid intelligence (IQ). We use the phrase “complaint–performance congruency” throughout this paper to represent the strength of the relationship between SMCs and performance on objective tests of memory.

Although performance on many objective tests of memory declines with age (Sinnott and Holen, 1999), the severity of SMCs is often found to remain consistent (Mendes *et al.*, 2008). Thus, it may be the case that many older adults often judge their memory performance against what they expect it should be for someone their age. The product of this in a correlational analysis examining the relationship between SMCs and memory performance is that age may act in a manner that Maassen and Bakker (2001) define as “classical suppression”. Likewise, premorbid IQ also appears to be unrelated to memory complaints (Jorm, 2004) but strongly related to memory performance (Frick *et al.*, 2011). Thus, it may be the case that both age and premorbid IQ suppress the strength of the relationship between memory complaints and memory performance. For age, this effect would only be present in research utilizing raw score measures of memory, since age-normed data would effectively remove the relationship between age and memory performance, which would likely remove the effect of suppression.

If age and premorbid IQ were found to act as suppressor variables in the relationship between SMCs and memory performance, such a result would be noteworthy given that raw score measures of memory continue to be utilized in SMC research (e.g. Mendes *et al.*, 2008; Minett *et al.*, 2008).

To examine this possibility, the current study utilized a correlational design to assess whether the relationship between SMCs and memory performance was suppressed by age and premorbid IQ. Given that, according to previous research, age and premorbid IQ appear to meet the criteria for classical suppression developed by Maassen and Bakker (2001), it was anticipated that the relationship between SMCs and memory performance will be strengthened by partialing out the effect of age and premorbid IQ on memory performance.

Methods

Participants

The participants comprised 121 community-dwelling older adults (81 females, 40 males) aged between 66 and 90 years ($M = 73.83$, $SD = 6.34$). Mean years of formal primary, secondary, and postsecondary education was 12.64 ($SD = 3.08$, range = 8–24) and all participants spoke fluent English. Participants were invited to take part in the study via advertisements in local newspapers distributed around Perth, Western Australia. All participants were asked about any vision or hearing impairments, current medications, previous head injuries, stroke, and whether they had sought assistance for any difficulties relating to memory or language. However, participants were only excluded from the present study when testing was not feasible (e.g. due to vision or hearing impairments) or when they had previously sought professional help for problems with memory or language (since the relationship between SMCs and memory performance might be artificially inflated by feedback provided by any formal testing carried out previously).

Apparatus

Subjective memory complaints were assessed using the Memory Functioning Questionnaire (MFQ) (Gilewski *et al.*, 1990). The MFQ is a 64-item, self-report questionnaire that assesses various aspects of memory through a general rating of memory problems and four scales: (1) General Frequency of Forgetting, (2) Seriousness of Forgetting, (3) Retrospective Functioning, and (4) Mnemonics. All items are assessed on a seven-point Likert scale and scores on the MFQ range from 0 to 448, with higher scores indicating subjective beliefs of better memory functioning.

Memory performance was assessed using raw scores from the Visual Reproduction (VR) and Logical Memory (LM) subtests of the Wechsler Memory Scale – Fourth Edition (WMS-IV)

(Wechsler, 2009). These subtests provide scores for immediate (VR-I and LM-I) and delayed (VR-II and LM-II) measures of memory for both visual and verbal information. Scores for these tests range from 0 to 43 (VR-I and VR-II), 0 to 53 (LM-I), and 0 to 39 (LM-II). Premorbid IQ was estimated using the National Adult Reading Test (NART) (Nelson, 1982). To maintain consistency with the MFQ and WMS-IV measures (so that higher scores imply better functioning), scores for the NART were calculated as the number of correctly pronounced irregular words out of 50.

Given that severity of depression is often found to be a pre-eminent predictor of SMCs, depression was assessed using the Depression Scale from the Depression Anxiety Stress Scales (DASS) (Lovibond and Lovibond, 1995). The DASS is a 42-item, self-report questionnaire; the Depression Scale comprises 14 of the 42 items and measures characteristics such as self-disparagement, pessimism about the future, life dissatisfaction, and inertia. Items are scored on a four-point Likert scale that reflects the extent to which the participant has experienced such characteristics of depression over the past two weeks. Scores on the Depression Scale range from 0 to 42, with higher scores reflecting a greater degree of distress.

Procedure

After providing informed consent, participants gave their date of birth and details regarding their education, any vision or hearing problems, current medications, previous head injuries, strokes, and any language or memory impairments about which they had spoken to a health professional. Participants then completed the immediate recall component of the VR and LM subtests (VR-I and LM-I). After 25 minutes, the delayed components of the VR and LM subtests were completed (VR-II and LM-II). In between the immediate and delayed components of the VR and LM subtests, participants completed the MFQ, DASS, and one other questionnaire used for a related study (NEO-Five Factor Inventory; Costa and McCrae, 1992). Participants generally did not finish all three questionnaires within 25 minutes, in which case they were put aside to be completed later in the session. However, the MFQ was given first and completed within the allocated time by all participants. Participants then undertook categorical fluency and picture description tasks, also being used in a related study. Finally, participants completed the NART. The session typically took around 100 minutes but ranged from approximately 90 to 120 minutes.

Data analysis

All analyses were conducted using SPSS (version 17). Zero-order correlations were carried out between all variables, which were then followed by two main sets of analyses: multiple regression and rank contrast correlations.

MULTIPLE REGRESSION ANALYSES

Hierarchical regression analyses were carried out to observe whether age and premorbid IQ suppress the relationship between SMCs and memory performance. There are many definitions of what constitutes a suppressor variable and much debate has taken place with regard to how and why suppression occurs. However, the concept fundamentally represents a situation whereby the predictive value of an independent variable increases, rather than decreases, after variance associated with an additional independent variable is partialled out (Conger, 1974; Velicer, 1978).

To test whether age and premorbid IQ increase the predictive value of the memory performance measures in predicting MFQ scores, four separate hierarchical regression analyses were conducted. We chose to conduct a separate regression analysis for each measure of memory rather than conduct a single regression analysis that incorporated all four memory measures as predictors for two reasons. First, there is likely to be considerable shared variance (possibly multicollinearity) between the four memory measures which, if entered into the same regression model, would likely return distorted regression weights and correlations that do not truly reflect the nature of their relationship with MFQ scores (this would be particularly problematic for predictors that typically show such weak zero-order correlations with SMCs). Second, any effect of suppression from age and premorbid IQ on complaint–performance congruency identified in the current study would depend on correlations among the four memory measures (which would be illogical given different studies incorporate different measures of memory). While the memory measures could be collapsed together to produce a single “memory” predictor, we felt this was inappropriate given they each assess theoretically distinct facets of memory functioning. For each regression analysis, the measure of memory performance, depression, and education were entered into the model first (model 1), followed by age (model 2), and then NART scores (model 3). Model 1 represents an analysis one might typically carry out when examining the unique relationship between SMCs and memory performance (i.e. with depression and education partialled out). Models 2 and 3 provide

Table 1. Zero-order correlations among MFQ scores, memory performance, age, and NART scores

MEASURE	1	2	3	4	5	6	7	8	M	SD
1. MFQ	—								278.22	42.53
2. VR-I	0.050	—							31.48	7.38
3. VR-II	0.116	0.775***	—						22.17	9.77
4. LM-I	0.195*	0.419***	0.378***	—					32.13	7.87
5. LM-II	0.191*	0.358***	0.360***	0.787***	—				17.33	6.67
6. Dep	-0.280**	-0.080	-0.111	-0.106	-0.040	—			5.38	7.76
7. Edu	0.029	0.028	0.146	0.253**	0.184*	-0.070	—		12.64	3.08
8. Age	0.053	-0.442***	-0.487***	-0.315***	-0.250**	-0.096	-0.091	—	73.83	6.34
9. NART	-0.088	0.292**	0.269**	0.374***	0.317***	0.074	0.397***	-0.217*	39.96	4.92

Note: MFQ = Memory Functioning Questionnaire, VR-I = Visual Reproduction I, VR-II = Visual Reproduction II, LM-I = Logical Memory I, LM-II = Logical Memory II, Dep = Depression Scale scores, Edu = years of education, NART = National Adult Reading Test. * $p < 0.05$, two-tailed. ** $p < 0.01$, two-tailed. *** $p < 0.001$, two-tailed.

an indication of whether age and premorbid IQ suppress this unique relationship.

RANK CONTRAST CORRELATIONS

Correlations were then carried out to observe how complaint–performance congruency was related to age and premorbid IQ. To obtain a measure of congruency between complaints and performance, a set of “rank contrast” scores was calculated for each participant, which reflects the difference between each participant’s rank on the MFQ and their ranks on each of the four measures of memory performance. For example, a rank of 75 on the MFQ and 55 on LM-II (where ranks of 1 and 121 correspond to the worst and best functioning, respectively) would provide a rank contrast score of 20 for LM-II for that participant (i.e. $75 - 55 = 20$). When two or more raw score values were tied, mean rank values were used. The rank contrast scores provide an indication of the discrepancy between a participant’s rating of their own memory in relation to their actual memory performance on each of the memory measures, relative to the rest of the sample. Rank contrast scores greater than 0 indicate that the participant’s MFQ rank is higher than their rank on a particular measure of memory, suggesting they rated their memory as better than their performance suggests, relative to the rest of the sample. On the contrary, rank contrast scores of less than 0 indicate that the participant’s MFQ rank is lower than their rank on a particular memory measure, suggesting they rated their memory as poorer than their performance suggests, relative to the rest of the sample.

Results

Means and standard deviations for MFQ, VR-I, VR-II, LM-I, LM-II, the Depression Scale,

education, age, and NART, as well as all zero-order Pearson correlations between them, are provided in Table 1.

Two-tailed Pearson correlations among the measures of memory performance were all positive, medium to very large (r between 0.358 and 0.787), and significant at $p < 0.001$. Correlations between age and measures of memory performance were all negative, medium to large (r between -0.250 and -0.487), and also generally significant at $p < 0.001$ (age and LM-II were significant at $p = 0.006$), suggesting that raw score memory performance declines with aging. Of the four measures of memory performance, only LM-I ($r = 0.195$) and LM-II ($r = 0.191$) were significantly related to MFQ scores ($p = 0.032$ and 0.036 , respectively). However, all correlations between memory performance and MFQ scores were in the expected direction. Correlations between NART scores and all memory performance measures were significant and of medium strength (r between 0.269 and 0.374), suggesting that memory performance is positively associated with premorbid IQ. Scores on the NART correlated significantly and negatively with age ($r = -0.217$, $p = 0.017$), suggesting that estimates of premorbid IQ decline with increasing age. However, NART scores did not correlate significantly with MFQ scores ($r = -0.088$, $p = 0.335$), suggesting little relationship with memory complaints. Finally, no significant relationship was found between MFQ scores and age ($r = 0.053$, $p = 0.561$).

Regression analyses

Table 2 provides a summary of the semipartial correlations, R^2 and ΔR^2 values for each model in each of the four regression analyses. While correlations were generally small for all memory measures across all three models, the semipartial correlations for all four measures of memory

Table 2. Semipartial correlations, R squared (R^2), and R squared change (ΔR^2) values for each model in each hierarchical regression analysis

MODEL	REGRESSION ANALYSIS								
	VR-I			VR-II			LM-I		
	1	2	3	1	2	3	1	2	3
VR-I	0.028	0.045	0.067	—	—	—	—	—	—
VR-II	—	—	—	0.086	0.114	0.130	—	—	—
LM-I	—	—	—	—	—	—	0.170	0.188*	0.218*
LM-II	—	—	—	—	—	—	—	—	—
Dep	–0.275**	–0.265**	–0.251**	–0.268**	–0.250**	–0.236**	–0.262**	–0.247**	–0.227**
Edu	0.008	0.013	0.048	–0.003	0.000	–0.036	–0.033	–0.032	0.016
Age	—	0.045	0.040	—	0.081	0.073	—	0.085	0.072
NART	—	—	–0.089	—	—	–0.096	—	—	–0.132
R^2	0.079*	0.081*	0.089	0.086*	0.092*	0.101*	0.107**	0.114**	0.132**
ΔR^2	—	0.002	0.008	—	0.006	0.009	—	0.007	0.017
								0.005	0.015

Note. VR-I = Visual Reproduction I, VR-II = Visual Reproduction II, LM-I = Logical Memory I, LM-II = Logical Memory II, Dep = Depression Scale scores, Edu = years of education, NART = National Adult Reading Test.

* $p < 0.05$, two-tailed. ** $p < 0.01$, two-tailed.

performance increased after adding both age and NART scores to each regression analysis. Semipartial correlations for memory performance measures in model 1 ranged from 0.028 to 0.181, with only LM-II reaching significance ($p = 0.040$). Semipartial correlations for memory measures in model 2 (age included) ranged from 0.045 to 0.193, with both LM-I and LM-II reaching significance ($p = 0.034$ and $p = 0.029$, respectively). Semipartial correlations in model 3 (age and NART scores included) ranged from 0.067 to 0.218, with LM-I and LM-II reaching significance (both $p = 0.014$).

Depression Scale scores were consistently related to MFQ scores across the three models in all regression analyses. Across the four regression analyses, semipartial correlations for Depression Scale scores ranged between -0.262 ($p = 0.003$) and -0.275 ($p = 0.002$) in model 1, between -0.247 ($p = 0.006$) and -0.265 ($p = 0.004$) in model 2, and between -0.227 ($p = 0.010$) and -0.251 ($p = 0.006$) in model 3. In contrast, years of education, age, and NART scores were not related to MFQ scores. For all three models in all four regression analyses, semipartial correlations for years of education, age, and NART scores were not significant ($p > 0.05$).

Overall, each of the regression models accounted for a relatively small amount of variance in MFQ scores, with R^2 values ranging from 0.079 to 0.132. The R^2 values for regression models that contained LM-I and LM-II (ranging from 0.107 to 0.132) were larger than the R^2 values for regression models that contained VR-I and VR-II (ranging from 0.079 to 0.101), suggesting that models incorporating verbal memory performance better predicted MFQ scores than models incorporating visual memory performance. All R^2 values were significant (ranging from $p = 0.003$ to $p = 0.042$), with the exception of model 3 for the VR-I regression analysis ($p = 0.054$). However, none of the R^2 change values were significant for any model in any of the regression analyses, suggesting that while the inclusion of age and NART scores improves the predictive value of each of the memory measures, it does not improve the ability to predict MFQ scores in general.

Rank contrast correlations

Given that the inclusion of both age and NART scores increased semipartial correlations for memory measures across all four regression analyses, rank contrast correlations were carried out to observe how age and NART scores were related to complaint–performance congruency. Two-tailed Spearman correlations were carried out between the participant's age and the rank contrast scores

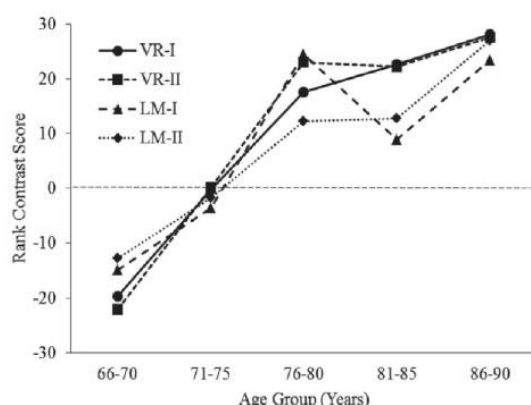


Figure 1. Mean rank contrast scores across age groups for each measure of memory.

for each of the memory measures. Age was significantly related to rank contrast scores for all four measures of memory. Rank contrast scores were most strongly related to age for VR-II (Spearman's $\rho = 0.409$, $p < 0.001$), followed by VR-I (Spearman's $\rho = 0.361$, $p < 0.001$), LM-I (Spearman's $\rho = 0.290$, $p = 0.001$), and LM-II (Spearman's $\rho = 0.252$, $p = 0.005$). The correlations suggest medium to large positive relationships between complaint–performance congruency and age, whereby younger participants rated their memory more stringently relative to their performance in comparison to older participants. To provide further indication of how complaint–performance congruency is related to age, the mean contrast scores across five age bands for each of the four measures of memory are displayed in Figure 1.

To determine how complaint–performance congruency was related to premorbid IQ, two-tailed Spearman correlations were carried out between NART scores and each of the rank contrast scores. As with age, NART scores were significantly related to rank contrast scores for all four measures of memory. Congruency was most strongly related to NART scores for LM-I (Spearman's $\rho = -0.356$, $p < 0.001$), followed by LM-II (Spearman's $\rho = -0.319$, $p < 0.001$), VR-II (Spearman's $\rho = -0.279$, $p = 0.002$), and VR-I (Spearman's $\rho = -0.253$, $p = 0.005$). The correlations suggest medium-strength negative relationships between complaint–performance congruency and NART scores, whereby participants with higher NART scores rated their memory more stringently relative to their performance compared to participants with lower NART scores. To provide further indication of how complaint–performance congruency is related to NART scores, the mean contrast scores across three groups for each of the four measures of memory are displayed in Figure 2.

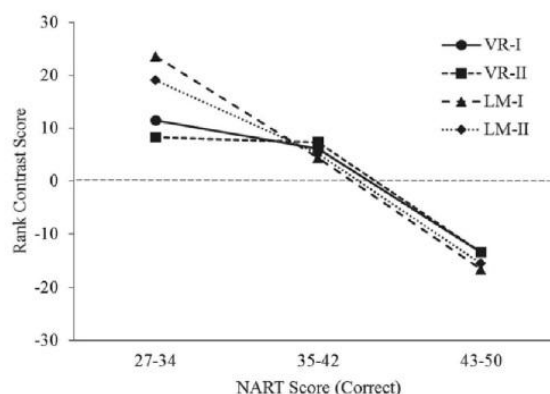


Figure 2. Mean rank contrast scores across NART score groups for each measure of memory.

Discussion

As hypothesized, the strength of the relationship between SMCs and memory performance increased after partialing out variance in memory performance associated with age and premorbid IQ. In all four regression analyses predicting MFQ scores, semipartial correlations for each of the memory performance measures increased after adding both age (model 2) and NART scores (model 3). These increases in semipartial correlations were small but consistent. Semipartial correlations for Depression Scale scores were considerably stronger than for the memory performance measures in model 1, although this discrepancy reduced after partialing out variance associated with age and NART scores. Indeed, the strength of the semipartial correlations for LM-I and Depression Scale scores were comparable in model 3 (0.218 and -0.227 , respectively). The contrasting effect of partialing out age and premorbid IQ on semipartial correlations for the memory performance measures and Depression Scale scores is worth noting given depression is generally accepted as the pre-eminent predictor of SMCs. It is also worth noting that partialing out variance associated with age and premorbid IQ had almost no effect on the overall R^2 value for any of the regression models (no R^2 change statistics were significant). Thus, differences in age and premorbid IQ partly explain why memory performance is generally a poor predictor of SMCs but they do not appear to improve the overall predictability of memory complaints.

Different types of suppressor variables have been depicted in the literature, although according to the definition of Maassen and Bakker (2001), age and premorbid IQ act as classical suppressor variables in the relationship between memory performance and SMCs. That is, both are related to other predictor variables but are not associated

with the outcome variable. Age, for example, was significantly correlated with all memory performance measures (r between -0.250 and -0.487) but not significantly correlated with MFQ scores ($r = 0.053$). Likewise, NART scores also correlated significantly with all memory performance measures (r between 0.269 and 0.374) but not significantly with MFQ scores ($r = -0.088$). Given that age and premorbid IQ fit the description of a classical suppressor, it is possible that they have contributed to an underestimation of the value of memory performance measures in predicting SMCs in previous research, even if this contribution is small. However, as far as we are aware, age and premorbid IQ have not been identified as suppressor variables in memory complaint–performance congruency beyond this study and this result may be dependent on the use of the MFQ or WMS-IV measures. Further research or re-analysis of available data could help to clarify whether this result extends to different measures of subjective and objective memory.

The rank contrast correlations help to further explicate the manner in which age and premorbid IQ are related to complaint–performance congruency. The significant, positive, and medium-strength Spearman correlations between age and complaint–performance congruency, as well as the mean rank contrast scores plotted in Figure 1, suggest that younger participants rated their memory more stringently relative to their performance compared to older participants. This result does not indicate that people over a certain age tend to overestimate their memory performance *per se*; rather it suggests that when using the MFQ (and possibly other SMC questionnaires) subjective appraisals of one's own ability appear to become more lenient with increasing age. This is presumably a consequence of the strong effect of aging on memory performance but lack of a relationship with memory complaints. Thus, while aging is clearly associated with decreases in raw score memory performance, it appears to be taken into account when subjective estimates are made about one's own memory (at least on the MFQ). This might explain the age-related differences in complaint–performance congruency found by Mendes *et al.* (2008) and why older participants appeared to overestimate their memory performance in the study by Frerichs and Tuokko (2006). The significant, negative, and medium-strength Spearman correlations between NART scores and complaint–performance congruency, as well as the mean rank contrast scores plotted in Figure 2, also suggest that participants with a higher premorbid IQ score rate their memory more stringently relative to their performance than

participants with a lower premorbid IQ score. Again, this result does not suggest that participants over a certain premorbid IQ score underestimate their memory performance; it simply suggests that subjective appraisals of memory are more lenient in those with lower premorbid IQ scores.

An outcome of these relationships is that by increasing variance in age and premorbid IQ in a sample, variance is introduced into memory performance that is not shared with SMCs. An important consequence of this that extends to previous literature and future research is that the strength of correlations between SMCs and raw score measures of memory will depend partly on the ranges of age and premorbid IQ of participants in the sample. Studies with samples of greater age and premorbid IQ ranges are likely to have more variance in memory performance not shared with SMCs and should expect, all other things being equal, to find weaker correlations with SMCs. Given that correlations between SMCs and memory performance are often weak but in the expected direction, this might account for some degree of inconsistency in the literature regarding whether or not memory performance is classified as a meaningful predictor of SMCs.

It is also unlikely that age and premorbid IQ are the only variables that act to suppress the relationship between memory performance and SMCs. For example, situational fatigue may be negatively related to memory performance but not related to SMCs (given that SMCs are typically based on past experiences). As a result, it may be premature at this stage to conclude that memory complaints are not a good indicator of current memory functioning and it raises the question of what other variables might suppress complaint–performance congruency by introducing variance into memory performance that is not shared with SMCs.

In terms of future research, there are several strategies that can be adopted to limit the effect of suppression on complaint–performance congruency resulting from differences in age and premorbid IQ. One option is to utilize norms, where available, to provide participants with a standard score for memory that is adjusted for age and IQ (although norms adjusted for both are rarely available). A second option is to utilize SMC questionnaires that incorporate norms, such as the Memory Assessment Clinics Self-rating Scale (MAC-S) (Crook and Larrabee, 1992). It would be interesting to repeat the current study with the MAC-S (rather than the MFQ) to observe any differences in complaint–performance congruency when raw scores and scores based on normed data for the MAC-S are used. A third option to minimize

suppression in correlational studies is to use the method employed in the current study; that is, to record age and take a measure of premorbid IQ and to take these variables into account when observing correlations between memory performance and SMCs. This third option is a quick and simple solution, given that a measure of premorbid IQ can be obtained from most participants via the NART in less than five minutes.

The results obtained in the present study need to be considered within the context of a few limitations. First, screening for previous testing of memory or language in participants was based exclusively on self-reports, which may have been unreliable. Participants may have forgotten about testing carried out in the past (although, in this case, the effect of previous testing on SMCs might have been small or nonexistent) or may have omitted details of previous testing due to associated feelings of embarrassment or distress (which likely would have inflated correlations between SMCs and memory performance, since feedback from formal testing would presumably influence beliefs about one's own memory abilities).

Second, mean NART scores were unusually high for an Australian sample (cf. Kiely *et al.*, 2011), as were years of education relative to other SMC studies (cf. Schmidt *et al.*, 2001; Zandi, 2004; Minett *et al.*, 2008). However, we expect that these differences in premorbid IQ and education had little influence on the results reported here and may, in fact, be attributable to the sampling procedures used. Given the sample was recruited via newspaper advertisements, those with a greater interest in research and education might have been more likely to respond. Likewise, we may have recruited participants who, on average, were more concerned about their memory than other similarly aged people in the community. We also feel, however, that this would have had little or no effect on these results.

Finally, it is standard procedure to administer the Verbal Paired Associates subtest of the WMS-IV (Wechsler, 2009) between the immediate and delayed parts of the VR and LM subtests, though this was replaced with three questionnaires in the current study. As a result, mean raw scores on the delayed component of the VR and LM subtests (i.e. VR-II and LM-II) should be interpreted with caution, given that the questionnaires may exhibit more or less interference than the Verbal Paired Associates subtest. Again, however, we feel that these factors were unlikely to have much effect on the results presented here.

Another issue worth pointing out is that the current study compared four theoretically distinct measures of memory with a single, overall measure

of subjective complaint. While some aspects of the MFQ more closely reflect visual and verbal memory (e.g. remembering names and faces), the questionnaire is not designed to delineate between visual and verbal or immediate and delayed aspects of memory functioning. If the measures of memory performance were compared against SMC questions that matched these measures of performance, it is likely that stronger relationships would have been reflected between complaints and performance. While we can only speculate on this point, we see no reason why age and premorbid IQ would not also act as suppressor variables when using SMC questions that are matched to each of the four measures of memory utilized in this study.

In summary, the results of the present study suggest that age and premorbid IQ act as suppressor variables in the relationship between memory performance and memory complaints. For immediate and delayed measures of visual and verbal memory, semipartial correlations increased after adding both age and NART scores to regression analyses designed to predict scores on the MFQ. Zero-order correlations indicated that age and premorbid IQ act in a manner consistent with what Maasen and Bakker (2001) describe as classical suppression. Finally, rank contrast correlations demonstrated memory complaint–performance congruency to be related to age and premorbid IQ, whereby older participants and those with a lower premorbid IQ judged their memory ability more leniently than younger participants and those with a higher premorbid IQ. An important consequence of these relationships is that congruency between SMCs and raw score memory performance in correlational research will depend partly on the range of age and premorbid IQ in the sample. This may account in part for whether or not the typically weak associations between SMCs and memory performance are deemed significant. The effect of suppression from age and premorbid IQ on complaint–performance congruency in correlational studies can easily be avoided by taking these variables into account, measures of which can usually be obtained in less than five minutes.

Conflict of interest

None.

Description of authors' roles

Matt Merema helped design the study, collected the data, conducted the analysis, and wrote the

paper. Craig Speelman helped design the study, supervised the collection of data and analysis, and reviewed the paper. Elizabeth Kaczmarek helped design the study, supervised the collection of data, and reviewed the paper. Jonathan Foster helped design the study, supervised the collection of data, and reviewed the paper.

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Neuroticism (Not Depressive Symptoms) Predicts Memory Complaints in Some Community-Dwelling Older Adults

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Objectives: To examine whether depressive symptoms are useful predictors of subjective memory complaints in community-dwelling older adults, beyond the predictive utility already provided by memory performance and characteristics of personality.

Design: Using hierarchical regression, we examined the relationship between depressive symptoms and subjective memory complaints, controlling for age, gender, education, memory performance, conscientiousness, and neuroticism. **Participants:** Community-dwelling older adults aged 66 to 90 years ($N = 177$) who responded to a newspaper advertisement for a memory study in Perth, Western Australia.

Measurements: The General Frequency of Forgetting scale (for memory complaints), Depression Anxiety Stress Scales (for depressive symptoms), NEO-Five Factor Inventory (for conscientiousness and neuroticism), and the Visual Reproduction and Logical Memory subtests from the Wechsler Memory Scale—4th Edition (for visual and verbal memory). **Results:** The hierarchical regression analysis indicated that while depressive symptoms significantly predicted memory complaints after variance associated with age, gender, education, memory performance, and conscientiousness was partialled out, they accounted for almost none of the variance in complaints when neuroticism was partialled out. **Conclusions:** The well-established relationship between depression and memory complaints may exist in some community-dwelling older adult populations only on account of the manner in which both are associated with neuroticism. (Am J Geriatr Psychiatry 2013; 21:729–736)

Key Words: Memory complaints, depression, neuroticism, conscientiousness, personality

While the nature of the relationship between memory complaints in older adulthood and objective memory performance is still being examined and clarified, it is now well-established that depression (or characteristics of it) is associated with

memory complaints of greater number and/or severity.^{1–6} Symptoms of anxiety, poorer physical and mental health, and less physical activity (all of which are factors heavily associated with depression^{7–9}) are also associated with subjective memory complaints.⁵

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Indeed, depression is arguably one of the most consistent predictors of memory complaints identified to date.¹⁰

The scientific literature also suggests depression is a more useful predictor of memory complaints than demographics, medical conditions (including stroke), memory performance, general cognitive functioning, and Apolipoprotein E status.^{10,11} Depression, however, is not the only factor consistently found to be associated with memory complaints. Various studies have identified a link between memory complaints and characteristics of personality.^{12–14} High levels of neuroticism and low levels of conscientiousness, for example, have been found to be associated with more frequent or severe complaints regarding memory.^{13,14} Given the overlap between depression and personality,^{15,16} such associations raise an interesting question about (i) the role of personality characteristics and (ii) the unique contributions of depressive symptoms, beyond personality factors, in mediating memory complaints.

Interestingly, previous studies have hinted at the possibility that depression might contribute little unique variance to the prediction of memory complaints beyond that already predicted by personality. Two studies have directly assessed personality characteristics (i.e., neuroticism and conscientiousness) and self-esteem as predictors of subjective memory complaints.^{13,14} Data from both studies show considerable decreases in the relationship between self-esteem (which is associated with depression¹⁷) and specific memory complaints when neuroticism and conscientiousness are partialled out of the statistical model. Research evaluating more general cognitive complaints has provided similar evidence. In a study of 123 older adults with Aging-Associated Cognitive Decline (AACD) and 291 healthy older adults, neuroticism accounted for a significant amount of variance in cognitive complaints for both the AACD and healthy older adult groups.¹² Furthermore, in the AACD group, neuroticism accounted for the most variance in cognitive complaints, while depression was not found to predict a significant amount of unique statistical variance. Together, these findings hint at the possibility that depression may not always be directly associated with memory complaints in old age but rather may sometimes be a surrogate for personality characteristics that can account well for both levels of memory complaints and depressive symptoms.

On the basis of these previous results together with research that suggests personality characteristics play a considerable role in depression vulnerability,¹⁵ the current study examined whether the association between depressive symptoms and memory complaints in community-dwelling older adults exists beyond personality characteristics, or whether it may constitute a *cum hoc, ergo propter hoc* fallacy¹⁸ (whereby depression and memory complaints correlate only because both are shaped by personality characteristics). To achieve this goal, the current study employed a correlational design to examine the relationship between depressive symptoms and memory complaints, both alone and in the context of characteristics of personality (i.e., neuroticism and conscientiousness). On the basis of previous literature,^{13,14} we hypothesized that the relationship between depressive symptoms and memory complaints would diminish considerably after partialling out statistical variance associated with characteristics of personality.

METHODS

Participants

The sample comprised 177 English-speaking older adults (115 women, 62 men) aged between 66 and 90 years ($M = 73.62$, $SD = 6.33$) residing within the Perth metropolitan area of Western Australia. Years of formal primary, secondary, and postsecondary education ranged from 8 to 24 years ($M = 12.56$, $SD = 2.86$). History of vision or hearing impairments, medications, previous head injuries, and stroke were recorded, although participants were only excluded from the current study when hearing or vision impairments did not allow for a valid assessment to be conducted. All participants were recruited via an advertisement in local newspapers promoting a study on memory. For the purposes of reviews and meta-analyses that may be undertaken, it should be noted that data from 121 of these participants were used in another recently published study.¹⁹

Materials

Subjective memory complaints were assessed using the General Frequency of Forgetting (GFF) scale from the Memory Functioning Questionnaire.²⁰ The GFF

scale is a 33-item, 7-point Likert scale designed to measure self-reports of memory problems across various tasks, contexts, and time frames. Objective memory performance was assessed using the visual reproduction (VR) and logical memory (LM) subtests from the Wechsler Memory Scale—4th Edition (WMS-IV).²¹ The subtests assess visual and verbal remembering, respectively; each providing a measure of immediate recall (VR-I and LM-I), delayed recall (VR-II and LM-II), and recognition memory (VR-R and LM-R). Depressive symptoms were measured using the Depression Scale from the Depression Anxiety Stress Scales (DASS),²² a 14-item, 4-point Likert scale (ranging from “Did not apply to me at all” through to “Applied to me very much, or most of the time”) designed to measure symptoms of self-disparagement, pessimism, life dissatisfaction, and inertia over the previous week. The Depression Scale of the DASS was developed for use in Australia and has been used in both clinical and community contexts as a measure of depression.^{23–25} It demonstrates acceptable psychometric properties²⁶ and clearly delineates between individuals with and without Major Depressive Disorder.²⁷ Neuroticism and conscientiousness were measured using the NEO-Five Factor Inventory (NEO-FFI).²⁸ Both scales are composed of 12 items and are scored on a 5-point Likert scale, ranging from “strongly disagree” to “strongly agree.”

Procedure

Once informed consent was obtained, participants provided details regarding age, education, vision and hearing difficulties, medication use, and history of any head injuries and stroke. The first component of each of the WMS-IV subtests (VR-I and LM-I) was then completed, after which 25 minutes was spent filling in the three questionnaires (Memory Functioning Questionnaire, NEO-FFI, and DASS). Participants typically did not complete all three questionnaires within the allocated 25-minute period, in which case they were momentarily put aside. The second components of the WMS-IV subtests (VR-II, VR-R, LM-II, and LM-R) were completed next, followed by any unfinished sections of the questionnaires.

Analysis

Multiple regressions were used to examine the unique contribution of depressive symptoms as

predictors of memory complaints beyond personality. However, given strong relationships between predictor variables in a multiple regression analysis can distort regression coefficients and that (based on previous literature²¹) we expected reasonably strong intercorrelations between the measures of memory, a preliminary factor analysis was carried out to determine whether a smaller number of latent variables could adequately account for memory performance. Raw scores from the immediate, delayed, and recognition measures of visual and verbal memory were subjected to Principal Axis factoring and a Direct Oblimin rotation. A nonorthogonal rotation was chosen because we expected factors to be correlated to some degree, regardless of the underlying structure. Factor scores from each of the factors derived were then utilized as measures of memory in the multiple regression analysis.

A three-stage hierarchical regression analysis was then carried out to examine the predictive utility of depressive symptoms beyond personality, while also controlling for memory performance and demographics. Depression Scale scores, memory factor scores, age, gender, and years of education were entered into the model first (model 1) to examine the predictive utility of depressive symptoms beyond demographics and memory performance but irrespective of personality. Previous literature suggests conscientiousness might be marginally more strongly related to memory complaints than neuroticism,^{13,14} so conscientiousness scores were entered into the model next (model 2). Neuroticism scores were entered into the model last (model 3).

RESULTS

Preliminary Factor Analysis

The Kaiser-Meyer-Olkin measure suggested good to very good sampling adequacy (0.78, individually all six measures of memory exceeded 0.72), indicating factor analysis was appropriate. Bartlett's test of sphericity also suggested sufficiently large correlations between the measures, $\chi^2_{[15]} = 560.82$, $p < 0.001$. Two factors with eigenvalues exceeding 1 were identified, which individually explained 57.3% and 20.5% of the variance in memory performance scores. The 3 measures of verbal memory loaded heavily on

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the first factor; namely, LM-I (0.84), LM-II (0.98), and LM-R (0.65). The measures of visual memory loaded heavily on the second factor, that is; VR-I (0.89), VR-II (0.87), and VR-R (0.68). All other loadings ranged between -0.07 and 0.05 , suggesting that a single measure of memory was not appropriate, and that separate measures of visual and verbal memory should be utilized. The correlation of 0.545 observed between the two factors was not strong enough to warrant concern for multicollinearity. Zero-order correlations between memory complaints, factor scores on the visual and verbal memory factors, depressive symptoms, characteristics of personality, and demographic variables are provided in Table 1.

Multiple Regression Analysis

Overall, the multiple regression analysis indicated that model 1 accounted for 14.1% of the variance in GFF scores, $F_{[6, 170]} = 4.649$, $p < 0.001$. Verbal memory factor scores (partial $r = 0.240$, $p = 0.002$) and Depression Scale scores (partial $r = -0.207$, $p = 0.006$) accounted for a significant amount of variance in GFF scores, although visual memory factor scores (partial $r = -0.051$, $p = 0.510$), age (partial $r = 0.036$, $p = 0.640$), years of education (partial $r = -0.075$, $p = 0.326$), and gender (partial $r = 0.144$, $p = 0.059$) did not. After entering conscientiousness, model 2 accounted for an additional 8.0% ($p < 0.001$) of the variance in GFF scores and a total of 22.1% of the variance, $F_{[7, 169]} = 6.864$, $p < 0.001$. Conscientiousness scores (partial $r = 0.306$, $p < 0.001$), verbal memory factor scores (partial $r = 0.266$, $p < 0.001$), and

Depression Scale scores (partial $r = -0.173$, $p = 0.024$) accounted for a significant amount of variance in GFF scores, although visual memory factor scores (partial $r = -0.090$, $p = 0.240$), age (partial $r = 0.021$, $p = 0.790$), education (partial $r = -0.053$, $p = 0.488$), and gender (partial $r = 0.084$, $p = 0.273$) did not.

After entering neuroticism, model 3 accounted for an additional 5.7% ($p < 0.001$) of the variance in GFF scores and a total of 27.8% of the variance, $F_{[8, 168]} = 8.092$, $p < 0.001$. Neuroticism scores (partial $r = -0.270$, $p < 0.001$), verbal memory factor scores (partial $r = 0.256$, $p = 0.001$), and conscientiousness scores (partial $r = 0.214$, $p = 0.005$) accounted for a significant amount of variance in GFF scores, although Depression Scale scores (partial $r = -0.019$, $p = 0.806$, 95% CI $[-0.166, 0.129]$) no longer accounted for a significant amount of variance with neuroticism scores included in the model. Likewise, visual memory factor scores (partial $r = -0.095$, $p = 0.216$), age (partial $r = -0.009$, $p = 0.912$), education (partial $r = -0.103$, $p = 0.182$), and gender (partial $r = 0.133$, $p = 0.083$) also failed to account for a significant amount of variance in GFF scores in model 3.

DISCUSSION

The current study examined whether the association between depressive symptoms and memory complaints in community-dwelling older adults exists beyond personality characteristics, or whether

TABLE 1. Zero-order Correlations Among Study Variables

Measure	1	2	3	4	5	6	7	8	M	SD
1. GFF	—								160.00	26.02
2. Dep	-0.220^a	—							4.95	6.95
3. Consc	0.336^b	-0.129	—						34.00	5.67
4. Neurot	-0.375^b	0.549^b	-0.315^b	—					19.10	7.38
5. VisMem	0.117	-0.157^c	0.117	-0.094	—				0.00	0.94
6. VerMem	0.279^b	-0.152^c	0.047	-0.117	0.590^b	—			0.00	0.96
7. Age	-0.037	-0.058	-0.009	-0.098	-0.600^b	-0.423^b	—		73.62	6.33
8. Edu	-0.022	-0.072	-0.080	-0.163^c	0.066	0.161^c	-0.048	—	12.56	2.86
9. Gender	0.156^c	0.125	0.186^c	0.146	0.065	0.161^c	-0.075	-0.048	—	—

Notes: Reported values are Pearson correlations ($df = 175$). Gender is coded as male = 1 and female = 2. GFF: General Frequency of Forgetting scale; Dep: depressive symptoms; Consc: conscientiousness; Neurot: neuroticism; VisMem: visual memory factor scores; VerMem: verbal memory factor scores; Edu: education.

^a $p < 0.01$, two-tailed.

^b $p < 0.001$, two-tailed.

^c $p < 0.05$, two-tailed.

depression and memory complaints correlate only because both are shaped by personality characteristics. As hypothesized, the relationship between depressive symptoms and memory complaints diminished after variance associated with personality characteristics (predominantly neuroticism) was partialled out. Depressive symptoms significantly predicted memory complaints when memory performance, conscientiousness, age, education, and gender were taken into account. However, the variance uniquely associated with depressive symptoms tended toward zero after neuroticism was also included in the model. Based on the assumption that more enduring personality characteristics can influence depression vulnerability,¹⁵ these results provide support for the notion that the relationship between depression and memory complaints in community-dwelling older adults may not be a direct one but may instead constitute an example of the *cum hoc, ergo propter hoc* fallacy, induced by the manner in which both depression and memory complaints are related to neuroticism.

In the current study, we refer to memory complaints as the subjective reports of problems independent of objective memory performance. While depressive symptoms may not show a direct relationship with such complaints beyond neuroticism, depressive symptoms exhibited a weak negative association with verbal (and visual) memory performance (see Table 1), which in-turn was weakly associated with complaints reported on the GFF scale. Thus, while depression may not always contribute to complaints directly, it may contribute indirectly via its association with memory performance. However, we did not test for this in the current study because (despite a weak negative association between depressive symptoms and memory performance) the DASS primarily assesses mood-related symptoms of depression and so would not adequately capture the changes in brain structure in depression that largely underlie associated memory dysfunction (e.g., hippocampal changes²⁹).

On a clinical level, the results of the current study have two important implications for mental health in older adults. Firstly, they have implications for mental health screening, given previous literature suggests that older adults complaining of memory problems should be assessed for underlying depression as well as memory dysfunction.¹¹ We do not argue that screening for depression is not warranted

in older adults complaining of memory problems; depression is unquestionably related to memory complaints. However, given memory complaints may materialize primarily through more enduring features of personality in some circumstances, older adults complaining of memory problems may exhibit an ongoing risk for depression (given the relationship between neuroticism and risk of depression onset), even if depression is not present at the time of assessment. This could be investigated longitudinally by observing empirically whether incidence of depression at follow-up is associated with memory complaints at baseline in a group of older adults with no previous history of depression, with our current findings suggesting that such incidence may be influenced by an individual's level of neuroticism.

A second implication of the results presented here is that they may help to further explain why memory and/or cognitive complaints (independent of objective cognitive performance) have been reported as being predictive of subsequent dementia.¹⁰ In addition to the relationship between concurrent depression and memory complaints already raised in the literature, the results presented here indicate that older adults with memory complaints likely exhibit an increased risk of subsequent depression, even if depressive symptoms are not present when the memory complaint is made. In combination with the increased risk of concurrent depression, greater vulnerability to future depression may further help to explain the higher rates of subsequent dementia, given recent research suggesting that a diagnosis of depression may subsequently double the risk for a dementia diagnosis in some contexts.³⁰

While some research¹⁴ suggests self-esteem (which is inversely associated with depression) does not uniquely account for a significant amount of variance in memory complaints beyond neuroticism, it has been found to account for a significant amount of unique variance in an earlier study.¹³ Likewise, while other research has indicated that depression does not account for a significant amount of unique variance in cognitive complaints in an AACD group,¹² the same study reported that it did account for a significant amount of unique variance in memory complaints in a healthy control group (more so, even, than neuroticism). This result was replicated in another study,³¹ although presumably the results are based, in part, on the same data (from the Interdisciplinary Study on

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Adult Development). Furthermore, several longitudinal studies have demonstrated that successful treatment of depression is associated with decreases in memory complaints.^{32,33}

We suspect the discrepancy between studies that do and do not find depression (or associated features) to be an important predictor of age-related memory (or cognitive) complaints might be largely attributable to sample characteristics. For instance, neuroticism appears to play more of a role in determining memory complaints than depression in individuals experiencing cognitive decline, which may reflect greater levels of worry in study volunteers at an increased risk of dementia (given their generally poorer memory performance, relative to the population at large).¹² Neuroticism scores were not abnormally high in the current study (mean neuroticism scores were on the 50th and 49th percentiles for men and women, respectively). However, given that we recruited through newspaper advertisements for this study, it is unlikely that the sample included many individuals with symptoms of depression that were severe enough to warrant a formal diagnosis of a Major Depressive Episode.

Lower depression severity in our sample may therefore account for why our results differed from those of several previous studies,^{12,13,31} suggesting that depression is a useful predictor of memory complaints in addition to the predictive utility offered by personality characteristics. These previous studies pursued participants more actively than we did for the current study, and therefore we may have recruited fewer and/or less depressed individuals. We do not regard this as a limitation to the current study, however, as we argue that the participant sample used here represents a sample of community-dwelling older adults who may be likely to present to health professionals or memory clinics with subjective memory concerns. Therefore, while we acknowledge that depression may be a useful predictor of memory complaints in some samples of older adults, memory complaints may be related primarily to neuroticism in older adults who more proactively seek to address their subjective memory problems. This issue deserves further attention, and could be examined by evaluating depression and neuroticism scores as predictors of memory complaints in groups that do and do not actively seek help for their subjective memory problems. Indeed, it

may be the case that depression increases memory complaints but decreases the likelihood of these complaints being reported to a health professional.

While zero-order and partial correlations between depressive symptoms and memory complaints observed in the present study were weaker than the corresponding correlations between personality characteristics and memory complaints, additional consideration needs to be given to this comparison. Depression Scale scores in our own data showed a considerable positive skew (see Table 1; note that Depression Scale scores on the DASS can range from 0 to 42), which is attributable to the manner in which symptoms of depression are characterized in the DASS. Although depression severity ultimately varies along a continuum, a large proportion of people in community samples typically report few symptoms of depression or no symptoms at all (this proportion may be even higher in samples where individuals are required to actively seek out the researchers to participate, such as was the case in the current study). We attempted to correct for this via various transformations, converting our data to ranks and grouping individuals into depressed and nondepressed groups based on the median score and on clinical cutoffs provided in the DASS manual.²² However, these procedures all returned weaker correlations for depression symptoms with memory complaints than was the case for the original raw scores.

Skewed data for measures of depression symptoms are evident in a number of studies,^{4,34} with these distributions likely impacting on the strength of correlations with memory complaints as well as with other variables. In contrast, measures of personality characteristics are less likely to return skewed data in community samples, because personality measures are typically designed for use in nonclinical populations. Correlations between depression scores, personality measures, and memory complaints should therefore be interpreted with this in mind and carefully considered when making comparisons regarding the predictive validity of memory complaints with characteristics of personality versus symptoms of depression. One may be able to avoid this potential problem with community samples in future by using wider-ranging measures of mood symptoms that vary from "extreme negative" to "extreme positive," rather than by applying measures that simply capture negative features of mood that are associated with depression.

A limitation of the current study is that, while there is evidence to suggest that characteristics of personality influence depression vulnerability,¹⁵ we cannot rule out the possibility that, conversely, depressive symptoms had an influence on reporting of the personality measures. That is, although depressive episodes may play little role in determining long-term aspects of personality, it is possible that participants in the current study reported higher levels of neuroticism because they were experiencing symptoms of depression.³⁵ Also, although the DASS clearly differentiates between individuals with and without a formal diagnosis of depression,²⁷ it is unlikely that many individuals with more severe depression participated in the current study, given our recruitment method. Consequently, the possibility of generalizing these results to a diagnostic context likely requires further consideration and investigation. Finally, it should also be noted that, in clinical testing, the Verbal Paired-Associates subtest of the WMS-IV is usually administered between the immediate and delayed components of the VR and LM subtests, while this was replaced with questionnaires (Memory Functioning Questionnaire, NEO-FFI, and

DASS) in the current study. However, we expect this change in procedure had little effect on the key relationships of interest reported here.

In summary, the results of the present study suggest that, outside of the predictive utility contributed by neuroticism, depressive symptoms may contribute little as unique predictors of memory complaints in some community-dwelling older adult populations. In older adults who actively seek out help for subjective memory problems, the “well-established” relationship between depression and memory complaints may instead represent a *cum hoc, ergo propter hoc* fallacy, whereby this relationship exists only on account of both factors being strongly associated with neuroticism. However, the impact of nonnormal distributions of depression data in community-based samples and the question of whether or not these results generalize to a diagnostic context require further investigation.

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Appendix B

Advertisement Used to Recruit Sample


Researchers at Edith Cowan University (ECU), Joondalup are interested in learning more about how older adults judge whether their memory is good, bad or somewhere in between.

So if you're over the age of 65 and live in the Perth metropolitan area, then we'd like to hear from you

Participating in the project is free and confidential. Taking part involves completing some memory tasks and filling in a few questionnaires. This requires between 1 and 2 hours and can be carried out within your own home.

If you're interested or would like some more information, please don't hesitate to give us a call or send us an email.

Matt Merema
Phone: (08) [REDACTED]
Email: mmerema@student.ecu.edu.au

The logo for Edith Cowan University (ECU) is located in the top right corner of the advertisement. It features the letters 'ECU' in a large, bold, blue font. Above 'ECU' is the word 'AUSTRALIA' in a smaller, red font. Below 'ECU' is the name 'EDITH COWAN' in a smaller, blue font. To the right of 'EDITH COWAN' is the word 'UNIVERSITY' in a smaller, red font. The entire logo is enclosed in a red rectangular border.

Appendix C

Table 23

Summary of Measures Used in the Current Study

Variable	Measure	Outcome
Applied Complaints	GFF scale	33 – 231
Global Complaints	GFF scale – Q1	See Chapter 7
Depression	DASS – Depression Scale / Subscales	See Chapter 7
Dysphoria		
Hopelessness		
Devaluation of Life		
Self-Deprecation		
Lack of Interest		
Anhedonia		
Inertia		
Anxiety	DASS – Anxiety Scale / Subscales	See Chapter 7
Autonomic Arousal		
Skeletal Effects		
Situational Anxiety		
Subjective Experience		
Neuroticism	NEO-FFI Scales	0 – 48
Extraversion		0 – 48
Openness to Experience		0 – 48
Agreeableness		0 – 48
Conscientiousness		0 – 48
Non-Verbal Memory	VR subtest	See Chapter 7
Verbal Memory	LM subtest	See Chapter 7
Age	Years	
Gender	Male or Female	
Education	Years	
Premorbid Intelligence	NART	0 – 50

Appendix D

Information Letter

Exploring Self-Reports of Memory

The Study

The current study is investigating how well people are able to predict their own memory capabilities and how this is influenced by personality characteristics and emotional wellbeing. The research is being conducted by Edith Cowan University (ECU) student, Matthew Merema, and conforms to the guidelines produced by the Edith Cowan University Committee for the Conduct of Ethical Research.

The research is being carried out as part of the Doctor of Philosophy (Clinical Psychology) award at ECU.

Participating in the research will take approximately two hours. During this time, you will be asked to participate in some memory tasks, some speech tasks and to complete some questionnaires that evaluate personality characteristics, emotional wellbeing and beliefs about your memory. As part of the research, you will also be asked questions about the presence of any language impairments, medications you may currently be taking and any previous head injuries or medical conditions (e.g., a stroke).

Risks or Discomfort

Some people may experience distress or discomfort when disclosing personal information about emotional wellbeing or their memory functioning. The process may also be distressing for some people should the testing procedures identify a potential impairment in memory or high levels of depressive symptoms, anxiety or distress. Please consider this carefully when deciding whether or not you wish to get involved in the study.

Please feel rest assured that any information you provide will be held in strict confidence. Your personal information will be stored in a locked filing cabinet at Edith Cowan University. At no time will your name or identifiable information be revealed when reporting the results of the study. Please also understand that your participation in this research is entirely voluntary and you are free to withdraw at any time during the study without penalty or justification. You are also able to remove any data that you have contributed.

Benefits of the Study

Participation in the project is free and provides you with a brief, non-clinical assessment of your memory. In addition, you can also feel satisfied that you have contributed to research investigating memory functioning and methods for identifying memory problems in their very early stages.

If you wish to participate, please read and sign the attached informed consent document and return it to myself or my primary supervisor, Craig Speelman.

If you have any questions relating to the study that you would like answered before deciding whether or not to participate they can be directed to:

Matt Merema

PhD Candidate

Edith Cowan University
100 Joondalup Drive
JOONDALUP WA 6027
Ph: 9304 4031
Email: mmerema@our.ecu.edu.au

Prof. Craig Speelman

Head of Psychology Department

Edith Cowan University
100 Joondalup Drive
JOONDALUP WA 6027
Ph: 6304 5724
Email: c.speelman@ecu.edu.au

If you would like to talk to an independent person regarding this study, please direct enquiries to:

Research Ethics Officer
Edith Cowan University
100 Joondalup Drive
JOONDALUP WA 6027
Phone: (08) 6304 2170
Email: research.ethics@ecu.edu.au

Appendix E
Informed Consent Document

I _____ have read and understand the information document provided and any questions I have asked have been answered to my satisfaction. I also understand that if I have further questions I can contact the researchers listed on the information letter. I freely agree to participate in the study, realizing that I may withdraw at any time without penalty. I agree that research data gathered for the study will only be used for the purposes of the research and that it may be published, provided I am not identifiable.

I understand that my participation in this project will involve:

- Undertaking memory tasks
- Undertaking speech tasks
- Completing questionnaires relating to personality, emotional wellbeing and my beliefs about my own memory

* I understand that my speech will need to be recorded during various tasks within the testing session and that this speech sample will be destroyed at the completion of the project.

Participant Signature

Date

Appendix F

Information Sheet Used During Testing Session

ID#: _____ Date: ____/____/____

Name: _____

Ph: _____

Address: _____

How participant heard about the study: _____

Additional Comments: _____

DOB: ____/____/____ Male / Female

Vision ☐ Hearing ☐

Education: _____

First Language: English ☐, other _____

Medication(s): _____

Previous Head Injury ☐ _____

Stroke ☐ _____

Language Impairment ☐ _____

Memory Impairment ☐ _____

Assessment

Completed

Info Cover Sheet	<input type="checkbox"/>
VR-I	<input type="checkbox"/>
LM-I	<input type="checkbox"/>
NEO-FFI	<input type="checkbox"/>
DASS	<input type="checkbox"/>
VR-II	<input type="checkbox"/>
LM-II	<input type="checkbox"/>
VR-II Copy.....	<input type="checkbox"/>
MFQ	<input type="checkbox"/>
NART	<input type="checkbox"/>

Appendix G

Table 24

Correlations Between All Variables Used in the Analyses

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1. GFF	-																									
2. Complainer	-.45 ^c	-	.16 ^a	.02	.09	.11	.08	.09	.19 ^a	.10	.10	.13	.14	.17 ^a	.08								.09	-.08		
3. Dep	-.18 ^a		-	.54 ^c	.58 ^c	.70 ^c	.59 ^c	.57 ^c	.54 ^c	.42 ^c	.58 ^c	.29 ^c	.59 ^c	.44 ^c	.52 ^c								-.02	.11		
4. Dysphoria	-.02			-	.49 ^c	.51 ^c	.48 ^c	.61 ^c	.52 ^c	.41 ^c	.39 ^c	.24 ^b	.40 ^c	.43 ^c	.37 ^c								-.06	.10		
5. Hopelessness	-.16 ^a				-	.54 ^c	.49 ^c	.60 ^c	.42 ^c	.32 ^c	.39 ^c	.17 ^a	.38 ^c	.46 ^c	.34 ^c								-.07	.06		
6. Devaluation	-.13					-	.61 ^c	.52 ^c	.45 ^c	.31 ^c	.41 ^c	.16 ^a	.49 ^c	.35 ^c	.42 ^c								.03	.12		
7. Self-Dep	-.16 ^a						-	.47 ^c	.42 ^c	.27 ^c	.44 ^c	.18 ^c	.41 ^c	.38 ^c	.34 ^c								-.08	.19 ^a		
8. Interest	-.13							-	.47 ^c	.43 ^c	.40 ^c	.14	.43 ^c	.43 ^c	.38 ^c								-.04	.05		
9. Anhedonia	-.20 ^b								-	.33 ^c	.43 ^c	.26 ^b	.40 ^c	.51 ^c	.36 ^c								-.01	.00		
10. Inertia	-.14									-	.35 ^c	.27 ^c	.28 ^c	.37 ^c	.32 ^c								-.19 ^a	.04		
11. Anx	-.15 ^a										-	.42 ^c	.58 ^c	.41 ^c	.44 ^c								-.03	.17 ^a		
12. Autonomic	-.21 ^b											-	.30 ^c	.33 ^c	.23 ^b								.07	.13		
13. Skeletal	.00												-	.30 ^c	.38 ^c								.05	.08		

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
14. Situational	-.26 ^c													-	.29 ^c								-.03	-.06		
15. Anx Affect	-.14														-								-.06	.02		
16. Neuroticism	-.38 ^c	.20 ^b	.49 ^c	.44 ^c	.44 ^c	.44 ^c	.48 ^c	.38 ^c	.43 ^c	.20 ^b	.41 ^c	.33 ^c	.28 ^c	.30 ^c	.42 ^c	-										
17. Extraversion	.42 ^c	-.24 ^b	-.26 ^b	-.21 ^b	-.27 ^c	-.15 ^a	-.19 ^a	-.26 ^b	-.28 ^c	-.23 ^b	-.19 ^a	-.35 ^c	-.08	-.30 ^c	-.19 ^a	-.44 ^c	-									
18. Openness	.21 ^b	-.01	.02	.10	-.08	-.04	-.03	.03	-.03	.09	-.02	-.07	-.02	-.07	-.13	-.14	.07	-								
19. Agreeableness	.22 ^b	-.16 ^a	-.29 ^c	-.20 ^b	-.22 ^b	-.25 ^b	-.26 ^b	-.23 ^b	-.23 ^b	-.16 ^a	-.10	-.14	-.17 ^a	-.15 ^a	-.13	-.22 ^b	.24 ^b	.07	-							
20. Conscientious	.34 ^c	-.12	-.08	-.15 ^a	-.09	-.07	-.15 ^a	-.11	-.17 ^a	-.20 ^b	-.05	-.07	.01	-.07	-.16 ^a	-.32 ^c	.41 ^c	-.03	.19 ^a	-						
21. LM	.28 ^c	-.25 ^c	-.20 ^b	.11	-.11	-.15	-.11	-.01	-.10	.03	-.16 ^a	-.16 ^a	-.07	-.15 ^a	-.04	-.12	.17 ^a	.17 ^a	.14	.05	-					
22. VR	.12	-.14	-.23 ^b	.03	-.15 ^a	-.16 ^a	-.15 ^a	-.08	-.19 ^a	.09	-.18 ^a	-.13	-.22 ^b	-.16 ^a	-.04	-.09	.13	.17 ^a	.17 ^a	.12	.59 ^c	-				
23. Age	-.02															-.06	-.02	-.21 ^b	-.02	-.02	-.33 ^c	-.46 ^c	-	-.14		
24. Gender	.16 ^a															.15	.06	.01	.14	.19 ^a	.16 ^a	.07		-		
25. Education	-.02	-.05	-.03	.00	-.07	-.07	-.11	-.05	-.09	-.10	-.06	-.07	-.01	.08	-.07	-.16 ^a	.03	.33 ^c	.00	-.08	.16 ^a	.07	-.12	-.05	-	
26. NART Errors	-.09	.05	.07	-.06	.08	.04	.00	.00	.00	-.13	.06	.11	.01	.09	.08	.04	.08	-.38 ^c	-.07	.05	-.38 ^c	-.26 ^b	.17 ^a	.00	-.27 ^c	-

Note: Values below the diagonal are Pearson correlations ($df = 175$). Values above the diagonal are Phi coefficients ($N = 177$). Age = Age Status (younger vs. older), Anx = Anxiety status (anxious vs. not anxious) Anx Affect = Subjective Experiences of Anxious Affect, Autonomic = Autonomic Arousal, Complainer = Complaint Status (high vs. low), Conscientious = Conscientiousness Scale scores, Dep = Depression status (depressed vs. not depressed), Scale scores, Devaluation = Devaluation of Life, GFF = General Frequency of Forgetting Scale scores, Interest = Lack of Interest, LM = LM factor scores, Self-Dep = Self Deprecation, Situational = Situational Anxiety, Skeletal = Skeletal Musculature Effects, VR = VR factor scores.

^a $p < .05$, ^b $p < .01$, ^c $p < .001$.

Appendix H

Results for Binary Logistic Regression Predicting Complaint Status from Anxiety Status

In stage one, anxiety status was not a significant predictor of global memory complaint status ($OR = 1.76$, 95% CI [0.75, 4.12], $p = .196$). In stage two, neuroticism scale scores ($OR = 1.06$, 95% CI [1.01, 1.10], $p = .023$) but not anxiety status ($OR = 1.13$, 95% CI [0.44, 2.88], $p = .806$) significantly predicted global memory complaint status. In stage three, only extraversion scale scores significantly predicted global memory complaint status ($OR = 0.93$, 95% CI [0.88, 0.99], $p = .024$). Anxiety status ($OR = 1.11$, 95% CI [0.43, 2.91], $p = .825$) and neuroticism scale scores ($OR = 1.03$, 95% CI [0.98, 1.09], $p = .207$) still failed to contribute significantly to the model. In stage four, LM factor scores were retained in the model ($OR = 0.61$, 95% CI [0.43, 0.86], $p = .005$). In this fourth model, anxiety status ($OR = 0.92$, 95% CI [0.35, 2.46], $p = .872$) and neuroticism scale scores ($OR = 1.04$, 95% CI [0.98, 1.09], $p = .194$) both failed to contribute significantly to the model. However, extraversion scale scores ($OR = 0.94$, 95% CI [0.89, 1.00], $p = .049$) and LM factor scores ($OR = 0.61$, 95% CI [0.43, 0.86], $p = .005$) were both significant predictors of complaint status. Summary statistics shown in Table 25.

Table 25

Predicting Memory Complaint Status from Anxiety, Personality and Contextual Variables

Model	Predictors Included	Nagelkerke R^2	Correctly Classified	χ^2	p
1	Anx	.01	53.67%	1.72	.190
2	Anx, Neu	.05	61.58%	7.08	.029
3	Anx, Neu, Ext	.09	61.02%	12.40	.006
4	Anx, Neu, Ext, LM	.15	63.28%	20.92	<.001

Note: Anx = Anxiety status, Extra = Extraversion scale scores, LM = Logical Memory factor scores, Neurot = Neuroticism scale scores.

A final binary logistic regression analysis was run with only LM factor scores and extraversion scale scores in the model, given they were the only significant predictors of global memory complaint status. As the only predictors included in the model, LM factor scores ($OR = 0.61$, 95% CI [0.43, 0.85], $p = .004$) and extraversion scale scores ($OR = 0.93$, 95% CI [0.88, 0.98], $p = .008$) both significantly predicted global memory complaint status. The model correctly predicted complaint status (high vs. low) membership 64.41% of the time, Nagelkerke $R^2 = .14$, $\chi^2(1) = 19.09$, $p < .001$.