Specificity, Emotional Valence, and the Relationship between the Past and the Future in Depression

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Abstract

It is now firmly established that remembering the past and imagining the future rely on common underlying cognitive and neural processes, with both abilities involving retrieval of autobiographical memory (AM) and being self-referential in nature. These processes are also closely related to other features of subjective experience, including identity, emotions, and personal goals. Given these links, it may be of no surprise that alterations in remembering the past and imagining the future are associated with various forms of psychopathology. In Major Depressive Disorder (MDD), the literature has focussed primarily on two different qualitative aspects of past and future thinking: specificity and emotional valence. Specifically, MDD is characterised by a tendency to generate past and future events reduced in specific quality (i.e., overgenerality) and predominantly negative in emotional valence (i.e., negative bias).

The studies in this thesis investigate the nature of specificity and emotional valence of both past and future autobiographical events in MDD. In *Study 1,* we investigated the specificity of both past and future autobiographical events, using two scoring methods to assess event specificity: the commonly-used Autobiographical Memory Test (AMT) and that of the Autobiographical Interview (AI). *Study 1* replicates previous findings suggesting reduced specificity of autobiographical events in MDD. *Study 1* extends on these findings to suggest overgeneral thinking in MDD is particularly marked for future thinking. In *Study 2,* we examined the content and emotional valence of both past and future autobiographical events. *Study 2* replicates previous findings suggesting a negative bias in the processing of remembered and imagined autobiographical events in MDD. Expanding on previous findings, the results of *Study 2* suggest that MDD is characterized by a tendency to generate more

negative *and* fewer positive autobiographical events, irrespective of temporal direction (e.g., past or future). These findings indicate that alterations in specificity and emotional valence affect both memory recall and future thinking in MDD, and suggest that both may contribute to the onset and maintenance of depressive illness.

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Chapter 1: General Introduction

"Memory is the treasury and guardian of all things" – Cicero

The ability to evoke previously-experienced events in the mind is a crucial part of the human experience. How we interpret our lives, from moment to moment (and over the life-span), is achieved through the recollection and application of past experiences. Remembering past events is highly adaptive, aiding survival by allowing organisms to utilize prior experiences to acquire knowledge, which can then be used to help govern present and future behaviour (Klein, Cosmides, Tooby & Chance, 2002; Tulving, 1995). For example, life-threatening experiences can facilitate important learning by providing templates for how and why we may want to avoid these and similar experiences in the future (Pillemer & Kuwabara, 2012). Further to this, and possibly unique to the human experience, memory is also essential to the construction and maintenance of a sense of self, providing the raw material from which our identity is comprised and shaped by (Prebble, Addis & Tippet, 2013). Considering the critical role remembering plays in general survival and the continuity of identity, understanding memory function would appear to be an important human endeavour; particularly in cases when the ability to remember becomes compromised.

Alterations in memory are commonly found to be associated with various forms of psychopathology. Early research indicated that in major depressive disorder (MDD), memory is characterized by a tendency to retrieve negative memories (i.e., negative bias). However, in the last 25 years, an accumulating body of evidence suggests that in MDD, it is not only *what* things are remembered that differs from healthy individuals; but also *how* things are remembered. Specifically, individuals with MDD have trouble retrieving specific memories, and tend to retrieve memories typified by an overgeneral quality. For example,

experimentally, when asked to provide a specific memory associated with the cue word "dog", individuals with MDD tend to provide abstract, non-specific memories (e.g., "I used to walk my dog every Sunday") rather than a specific event (e.g., "Last Sunday, I took my dog to the beach and she chased the birds"). This phenomenon is often referred to as overgeneral memory (OGM; Williams et al., 2007; Williams & Scott, 1988); however there has been some indication that depressed individuals also exhibit difficulties in constructing specific future events (Williams et al., 1996). In MDD, overgeneral thinking is associated with poorer outcomes and delayed recovery of depressive illness (Brittlebank, Scott, Williams & Ferrier, 1993; Dangleish, Spinks, Yiend & Kuyken, 2001), and has been shown to continue beyond acute depressive episodes (Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Spinhoven et al., 2006). Although it is not entirely clear whether this phenomenon represents a state or trait marker of MDD, it is quite clear that overgeneral thinking contributes in some way to the maintenance and possibly the onset of the disorder. The current chapter will begin by reviewing current conceptualisations of memory and future simulation. Then, research regarding the nature of autobiographical processes will be reviewed, followed by a discussion about overgenerality in MDD, and the implications of this phenomenon in terms of remembering the past and imagining the future.

1.1 Memory systems

There has been a relatively long history of experimental research on memory and learning, starting with the seminal work of Hermann Ebbinghaus (1885/1964). The last 40 years in particular have seen enormous strides in memory research, predominantly with the use of behavioural experiments and observations from neuropsychological populations. More recently, developments in neuroimaging technology have allowed neuroscientists and cognitive psychologists to explore the complex architecture of the brain in relation to memory

processes (Tulving & Craik, 2000). Currently, memory as a scientific field of inquiry is theoretically diverse, and has become conceptualised from a number of different sub-disciplines of psychology, including evolutionary, developmental, social, clinical, and cognitive. In particular, developments in cognitive research have been instrumental in conceptualising the functions of human memory.

Previous research by cognitive theorists (e.g., Tulving, 1972) suggests that rather than being a unitary phenomenon, human memory encompasses a number of separate but interacting systems. For example, a distinction has been made in terms of *declarative memory* (see also *explicit memory*; Graf & Schacter, 1985; Schacter & Graf, 1986) which refers to the conscious recollection of facts and events (Squire, 1992; Squire & Zola, 1996). In contrast, *non-declarative memory* (see also *implicit memory*; Graf & Schacter, 1985; Schacter & Graf, 1986) refers to a relatively heterogeneous group of unconscious learning abilities, including procedural skills, priming, and conditioned responses (Squire, 1992; Squire & Zola, 1996).

Moreover, there are different types of declarative memory: namely *episodic* memory and *semantic* memory (Tulving, 1972). Episodic memory represents specific episodic events that have occurred within discrete periods of time and in specific places (e.g., a specific memory of eating breakfast this morning). These memories involve many different aspects of experiences including phenomenological features like perceptual, affective and spatiotemporal details of events (Piolino, Desranges & Eustache, 2009). Episodic memories are typified by their personal and subjective nature, allowing individuals to mentally travel back in time and re-live experiences. In contrast, semantic memory is characterized by factual and conceptual knowledge without the specific context from which that knowledge was acquired (e.g., remembering that the capital of New Zealand is Wellington). It is possible that

someone may remember the context in which they acquired a semantic memory, however semantic information is generally derived from multiple specific events over time, and this factual information can be recalled without reference to a specific event (Binder, Desai, Graves & Conant, 2009).

Episodic and semantic memory systems are distinguished by their association to two functionally different states of consciousness: namely *autonoetic* and *noetic* consciousness (Tulving, 1985; Wheeler, Stuss & Tulving, 1997). Autonoetic consciousness is characterized by a subjective sense of self in time, whereby individuals are able to relive previous subjective experiences by mentally placing themselves back in the moment. A combination of self, autonoetic consciousness and a subjective sense of time are required to retrieve episodic memories. In contrast, noetic consciousness is characterized by an ability to be aware of information about the world, and to cognitively utilize and sometimes manipulate that information without the necessity of re-experiencing the specific context in which that information was acquired. Accordingly, noetic consciousness is associated with the semantic memory system.

There is now a wealth of neuropsychological and neuroimaging evidence to support the notion of distinct episodic and semantic memory systems (Graham, Simons, Pratt, Patterson & Hodges, 2000; Kitchener, Hodges & Rosaleen, 1998; Levine et al., 2004; Simons, Graham, Galton, Patterson & Hodges, 2001; Temple & Richardson, 2004; Tulving, Hayman & MacDonald, 1991; Tulving, Schacter, McLachlan & Moscovitch, 1988; Vargha-Khadem et al., 1997). For example, Tulving and colleagues (1988) performed experimental tests on the memory of an amnesic man, patient K.C., who experienced a closed-head injury leaving him with extensive damage to his brain. Although K.C. was unable to recollect any

personal event from his life, or form new memories of events, he was able to provide personal semantic knowledge (e.g., names of schools he attended, names of classmates, names of high school teachers), suggesting preservation of some semantic memories but not episodic memories. Additionally, in an fMRI study by Levine and colleagues (2004), the authors found that eliciting episodic and semantic memories engaged distinct patterns of neural activation. Specifically, episodic memories activated particular areas in the medial temporal lobes (e.g., the hippocampus), posterior cingulate and diencephalic regions, while semantic memories activated aspects of the lateral temporal and parietal cortices.

Research investigating episodic and semantic memory systems has been fundamental to understanding the role of the medial temporal lobes to the encoding and retrieval of episodic memories, and the role of the anterior temporal lobes for the retrieval of semantic memory (Irish & Piguet, 2013). However, while this subsystems approach has been helpful in explaining some of the findings in the literature, Rubin (2012) suggests that rather than being separate systems of memory, the distinction is more reflective of the fact that memory of knowledge and memory of events refer to two different ontological categories. Indeed memories can involve elements of both episodic detail and semantic knowledge (Levine, Svoboda, Hay, Winocur & Moscovitch, 2002). In fact, previous research (e.g., Burianová & Grady, 2007) suggests that retrieval of these forms of memory recruit overlapping brain networks. Conceptually, episodic and semantic memory can be bound into a single construct under the umbrella of Autobiographical Memory (AM). The retrieval of AM generally involves the engagement of both episodic and semantic systems (Irish & Piguet, 2013). For example, in a recent meta-analysis of 120 functional neuroimaging studies, Binder and colleagues (2009) found a high degree of overlap in the semantic memory system and the

core autobiographical memory network, suggesting that AMs contain a high level of semantic information in addition to episodic detail.

According to Conway and Rubin (1993), AM is defined as "memory for the events of one's life" constituting "a major crossroads in human cognition where considerations relating to self, emotion, goals, and personal meanings, all intersect" (p. 103). Early theorists proposed that AM was a particular type of episodic memory (e.g., Tulving, 1983), however, most researchers now agree that AM also has both episodic and semantic components, whereby episodic AM reflect memories of discrete autobiographical events (e.g., memory of 21st birthday party) and semantic AM reflect personal factual information (e.g., knowledge of age) (Addis & Tippet, 2008; Baddeley, 1992; Kopelman, Wilson, & Baddeley, 1989; Meulenbroek, Rijpkema, Kessels, Rikkert & Fernández, 2010). Thus, AM goes beyond merely representing episodic events, and involves the integration of experiences into a factual chronological history, alongside notions of perspective, interpretation, and evaluation across time (Fivush, 2011).

Another important aspect of AM is its relation to notions of identity. AM contributes significantly to our sense of self, the roles we embrace, and the goals we set ourselves (Berntsen & Rubin, 2012). As mentioned, earlier conceptualisations of memory had placed significant emphasis on episodic memory as being fundamental to AM and consequently to the continuity of self (Schacter, 1996; Tulving, 2002), however recent neuropsychological evidence suggests that loss of episodic memory does not necessarily result in a loss of identity (Haslam, Jetten, Haslam, Puliese & Tonks, 2011). While some argue that the self is a unitary phenomenon experienced from a singular point of view, many theorists suggest that the self is likely constituted from many different processes including, memory, personal agency,

conscious self-reflection, and awareness of continuity (Klein, 2012; Klein & Gangi, 2010; Leary & Tangney, 2012). Thus, the self is considered an incredibly complex and multidimensional construct (Rathbone, Conway & Moulin, 2011; Power, 2007). Accordingly, the interplay between AM and the self is likely to be equally complex. Prebble and colleagues (2013) suggest the involvement of AM to aspects of the self may be multifaceted. Specifically, episodic memory (and thus autonoetic consciousness) contributes to the phenomenological and subjective experience of self (i.e., "I-self"), whereas semantic memory (and thus noetic consciousness) contributes to the objective content of the self (i.e., "Me-self). Thus, both forms of memory are important in establishing and maintaining a coherent sense of self (Prebble, Addis & Tippet, 2013).

Conway and colleagues' (Conway, 2001; Conway & Pleydell-Pearce, 2000; Conway, Singer & Tagini, 2004) hierarchical model of AM has been instrumental to understanding how semantic and episodic elements of memory interact with the self. The authors propose the existence of a *self-memory system* (SMS). The SMS is a superordinate system which helps coordinate autobiographical processes involved in remembering. Through this system, AMs are managed by the executive processes of the *working-self* – the cognitive mechanism that represents the self as a transient hierarchical goal system, which facilitates the interpretation of experiences in line with self-schemas, maintaining coherence of identity throughout the lifespan. According to this model, AMs are "transitory dynamic mental constructions generated from an underlying knowledge base" (Conway & Pleydell-Pearce, 2000, p. 261). This underlying knowledge base (i.e., *the autobiographical knowledge base*) is formed by episodic and semantic memory systems. The SMS functions to coordinate the interaction between the autobiographical knowledge base and the working self to integrate significant

autobiographical events into the self, facilitating both the encoding and retrieval of self-relevant information (Conway, 2005).

Furthermore, the autobiographical knowledge base contains three levels of representation. At the highest level, *Lifetime periods* represent prolonged and extended periods of time with distinct start and end points (e.g., "When I was at school", "My teenage years"). At the intermediate level (i.e., more specific than lifetime periods), *General events* reflect both repeated events (e.g., "Attending lectures", "Riding my bike") and single extended events (e.g., "My trip to Europe). General events are typically abstract in nature. The general event level appears to be the assumed default level where one often gains access to the autobiographical memory base (Haque & Conway, 2001; Williams et al., 2007). At the lowest level, *event specific knowledge* (ESK) reflects specific episodic details of an event, including sensory-perceptual information and affective features of experiences, rather than the abstract, more semantic representations reflected at higher levels of the autobiographical knowledge base.

1.2 Future simulation

There has been recent interest in the role that memory plays in simulating the future. It was Tulving (1985) who first discussed the relationship between memory recall and future simulation, after observing amnesic patients who were lacking in their subjective awareness of time. Tulving suggested that the retrieval of episodic memory involves "mental time travel" (i.e., autonoetic consciousness), allowing us not only to subjectively project ourselves into the past when remembering; but also into the future when imagining. Observations of impairments in both recall and future thinking in amnesic patients led Tulving to propose a link between the way we remember the past and imagine the future.

In recent years, there have been a number of experimental studies investigating the relationship between remembering the past and imagining the future (e.g., Addis, Wong & Schacter, 2007; Addis, Pan, Vu, Laiser & Schacter, 2009; Botzung, Denkova & Manning, 2008; Race, Keane & Verfaellie, 2011; Szpunar & McDermott, 2008; for a review, see Schacter, Addis & Buckner, 2008). For example, in a neuroimaging study conducted by Addis and colleagues (2007), the authors found a considerable degree of overlap of neural activation when participants were retrieving past events and imagining future events. Specifically, medial parietal, medial prefrontal regions, as well as the left hippocampus, the left temporal pole and the lateral parietal cortex were all active during the recollection of past events *and* future thinking. This common core brain network found to be engaged by recalling the past and simulating the future has since been replicated by a number of other studies (e.g., Addis & Schacter, 2008; Botzung, Denkova & Manning, 2008; Hassabis, Kumaran & Maguire, 2007; Okuda et al., 2003; Szpunar, Watson & McDermott, 2007).

To explain this relationship between past and future events, researchers in this area (e.g., Schacter & Addis, 2007a, 2007b) have proposed the *constructive episodic simulation hypothesis.* This theory suggests that both memory recall and future simulation rely on the same underlying cognitive processes, whereby episodic memory provides the raw material from which both past and future events draw from. Past events involve the reintegration of relevant episodic details and, in terms of imagining the future, novel events can be produced by flexibly creating new combinations of previously acquired episodic details (Schacter & Addis, 2009). An advantage of this type of memory system is that it enables novel, future scenarios to be simulated cognitively without individuals actually being subjected to the situation. However, a potential disadvantage of this type of system is that individuals can be

subject to memory flaws, such as misattribution and false recognition (Schacter & Addis, 2007; Schacter & Dodson, 2001).

1.3 Autobiographical processes in major depressive disorder

Given the importance of past experiences to different levels of cognitive functioning, including future thinking and the continuity of self, it may not be surprising that disturbances in AM are associated with a variety of mental health problems. Memories of distressing and traumatic experiences may threaten one's perceptions about themselves, about others, about the world and about the future. Impairments in autobiographical processing are most commonly associated with amnesic syndromes and neurodegenerative disorders. However, previous research suggests that impairments in both remembering the past and imagining the future are also evident in many different psychiatric disorders. For example, alterations in autobiographical processing have been reported in individuals with anxiety (Airaksinen, Larsson & Forsell, 2005; Burke & Mathews, 1992; MacLeod & Byrne, 1996; MacLeod, Tata, Kentish & Jacobsen, 1997), schizophrenia (D'Argembeau, Raffard & Van der Linden, 2008; Feinstein, Goldberg, Nowlin & Weinberger, 1998; Huron et al., 1995), obsessive compulsive disorder (OCD; Keen, Brown & Wheatley, 2008; Muller & Roberts, 2005; Radomsky & Rachman, 1999), post-traumatic stress disorder (Brown, Root, Romano, Chang, Bryant & Hirst, 2013; Moradi et al., 2008; Robinaugh & McNally, 2010), bipolar disorder (Bearden et al., 2006; King et al., 2011; Robinson et al., 2006), and critically for this review, MDD (Bearden et al., 2006; MacLeod & Byrne, 1996; MacLeod & Cropley, 1995; Williams & Scott, 1988; Williams et al., 1996).

MDD is a debilitating mental health problem, with a global lifetime prevalence estimate ranging between 4% -10% (Kessler et al., 2009). According to the World Health

Organisation, depression is the leading cause of disability worldwide (WHO, 2012). As defined by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V; APA, 2013), depression is characterised by a cluster of emotional, cognitive, behavioural and somatic symptoms including depressed mood; anhedonia; significant fluctuations in weight; insomnia or hypersomnia; psychomotor agitation or retardation; fatigue or loss of energy; feelings of worthlessness or excessive guilt; diminished ability to think or concentrate; and recurrent thoughts of death. According to cognitive models, MDD is characterised by a "negative cognitive triad" – namely negative views of experience (both past and present), negative views of the future and negative views of the self (Beck, 1967, 2002).

1.3.1 Biases of autobiographical processing in MDD

Although not a formal part of the diagnostic category, memory difficulties are common for individuals who experience MDD. In alignment with the negative cognitive triad as conceptualised by Beck (1967), early research investigating memory in MDD indicated a negative bias in AM processes. For example, Lloyd and Lishman (1975), in one of the earliest experimental studies investigating the nature of AM in MDD, employed a cue-word paradigm (Galton, 1879; Crovitz & Schiffman, 1974) in which participants were instructed to recall either a pleasant or unpleasant memory associated with a stimulus word. Response times were recorded and were contrasted to give a ratio score (i.e., unpleasant/pleasant). Additionally, the Beck Depression Inventory (BDI) was administered to investigate the relationship between differences in memory valence and depression severity. In contrast to previous evidence suggesting that healthy adults recall pleasant experiences more readily than unpleasant experiences (Beebe-Center, 1932; Lishman, 1972; Rapaport, 1943; Ritchie et al., 2006; Walker, Vogl & Thompson, 1997), Lloyd and Lishman (1975) found a differential pattern of memory recall in their sample of depressed individuals. Specifically, for more severely

depressed participants, the authors found the opposite pattern in comparison to healthy adults: namely, faster recall of negative experiences relative to positive experiences. Likewise, the authors found that increasing depression severity was associated with a progressively diminished ratio score, suggesting that the tendency to recall negative experiences faster relative to positive experiences increased with greater severity of depressive illness. This evidence indicated that memory processes in depression may reflect mood-congruency, such that low mood produces, or is possibly produced by, a preoccupation with negative AM recall. Alternatively, the authors also proposed that the pattern of results may suggest that negative events may just be more accessible for individuals with depression, because depressed individuals have simply experienced more negative events in their lives.

Following this influential study, Teasdale and Fogarty (1979) used a similar cue-word paradigm in a sample of healthy adults, including a mood-induction component to elicit either a depressed mood or happy mood. For each induction, participants read aloud a series of self-referent statements associated with the target mood, which ranged in intensity (e.g., from mildly depressing to disparaging statements). After undergoing mood induction, participants were then instructed to generate pleasant or unpleasant experiences in response to cue-words. As predicted, the authors found that the ratio scores were significantly smaller in the depressed mood condition in comparison to the happy mood condition, suggesting that the mood induction shifted AM recall to be mood congruent. Interestingly, although Lloyd and Lishman (1975) found that depressed participants exhibited both faster recall of negative experiences and slower recall of positive experiences relative to controls, this sample of healthy adults was characterised by only slowed recall of positive experiences. This observation suggested that the mood disturbance produced by the mood induction was effective in reducing participants' accessibility to recalling positive memories, rather than

increasing accessibility to negative experiences. It is likely however, that in MDD, AM processing deficits may be two-pronged, reflecting both a decreased access to the retrieval of positive memories, and an increased access to the retrieval of negative memories. While earlier cognitive models of depression (e.g., Beck, 1967) had initially proposed that depressing thoughts and memories cause depression, Teasdale and Fogarty suggested that there may be a more reciprocal relationship between cognition and depression. Specifically, while certain negative experiences may increase the likelihood of developing MDD, biases in AM processes, in terms of increased access to negative memories and decreased access to positive memories, may exacerbate and maintain depressive symptoms.

Previous research suggests that depression is also associated with a tendency to imagine future negative events faster relative to positive events (Lavender & Watkins, 2004; MacLeod & Copley, 1995; MacLeod, Tata, Kentish & Jacobsen, 1997; Miles, MacLeod & Pote, 2004). For example, in a similar paradigm to Lloyd and Lishman (1975), MacLeod and Cropley (1995) instructed a community sample to imagine specific positive (e.g., "You will feel confident") and negative (e.g., "You will feel rejected") future events, and additionally to rate the subjective probability of each imagined event. The authors found that the depressed group were faster to imagine future negative relative to positive events, while the control group were faster to imagine future positive relative to negative events. Additionally, the findings suggested that the depressed group rated negative future events as more likely to actually occur than positive future events, suggesting a negative bias future thinking in depression. In contrast, the control group exhibited no difference in the probability ratings of negative and positive future events.

1.3.2 Overgeneral autobiographical events in MDD

Extending further on this evidence of alterations in autobiographical processing, Williams and Broadbent (1986) were interested in investigating the mood congruency of autobiographical events in individuals who had attempted suicide. The authors hypothesised that immediately before an attempted suicide, a negative bias in memory recall may impact individuals' responsiveness to persuasion or their likelihood of using effective coping strategies. Additionally, they speculated that this phenomenon may persist after the suicide attempt and thus be a potential risk factor for further suicide attempts. To elicit memories of emotional valence, instead of using a traditional cue-word paradigm of neutral words (e.g., Galton, 1879; Crovitz & Schiffman, 1974) and asking for pleasant or unpleasant AMs, the authors employed cue-words of positive (e.g., "happy", "safe", "successful") and negative (e.g., "sorry", "angry", "lonely") emotional valance. This method has become known as the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986). In the AMT, participants are given 60 seconds to retrieve a specific personal AM (e.g., an event that has occurred within a 24 hour period) in response to each cue-word. If participants are unable at first give a specific response, they are then prompted to do so.

Similar to previous findings with depressed participants, the authors found that relative to control participants, patients who had attempted suicide were significantly slower to respond to positive cue-words but faster to respond to negative cues. Rather serendipitously, the authors also found that suicidal participants had difficulty providing specific memories for both positive and negative cue-words. For almost half of cue-words presented, irrespective of emotional valence, suicidal participants responded with AM descriptions that summarised a category of events (e.g., "I used to walk my dog") rather than providing a specific episodic event as instructed. In contrast, control participants provided

specific AMs (e.g., "When walking my dog, she ran off from the beach and onto the road") for more than 80% of the cue-words. In a follow-up study, Williams and Scott (1988) replicated this finding in a sample of individuals with MDD. While participants with MDD exhibited difficulties retrieving specific AMs for both positive and negative cue-words, this was more profoundly the case for positive AMs. These two studies by Williams and colleagues were instrumental in shifting the focus in MDD research from quantifying biases in responses time, to emphasise differences in the *quality* of autobiographical events, ultimately leading to the discovery of overgeneral thinking as a core cognitive deficit in MDD.

Consistent with the constructive episodic simulation hypothesis (Schacter & Addis, 2007a, 2007b) and the notion that past and future events are closely related, the tendency for overgeneral thinking in MDD affects not only the retrieval of AMs, but also other forms of autobiographical thinking including the imagination of future events. For example, expanding on their previous work on overgenerality, Williams and colleagues (1996) modified the AMT to include the Future event task (FET). The FET is a future oriented version of the AMT which requires participants to imagine specific future events in response to cue-words. The authors employed the AMT and the FET to elicit the generation of specific past *and* future events. They found that that depressed individuals generated significantly more overgeneral past *and* future events in comparison to controls. Additionally, there was a significant correlation between the level specificity of past and future autobiographical events for both experimental groups.

Typically, overgenerality is characterised by an inability or difficulty in generating specific autobiographical events, and the events generated tend to be more abstract in content,

lacking in episodic specificity (i.e., specific in time and place) (Williams et al., 2007). It is important to note that generalising across events is, in of itself, not a deficit. It is a natural tendency of all humans; generalisation allows individuals to flexibly access autobiographical information effectively and efficiently, and to capture a summary or a gist of memories when doing so is sufficient, rather than having to generate specific episodic content. However, in various forms of psychopathology, the ability to flexibly control or modulate the level of specificity of recall becomes impaired, and individuals employ an overgeneral pattern more globally. Experimentally, this impairment is evident even after initial practice trials where participants are given examples of what is meant by a "specific event" (e.g., AMT instructions state that in response to the word "enjoy", it would not be okay to say "I always enjoy a good party" because this does mention a specific time, but it would be okay to say "I went to Jane's party last Wednesday and it was really enjoyable") and with further prompting throughout testing. Overgeneral AMs often take two distinct forms: categorical AMs which are summarised over repeated instances of an event (e.g., "waiting at the bus stop", "making mistakes"); and extended AMs which take place over a long period of time (e.g., "Holiday in France") (Williams & Dritschel, 1992). Research suggests that in MDD, depressed participants have a greater tendency to provide categorical but not extended memories (Goddard, Dritschel & Burton, 1996; Williams & Dritschel, 1992).

Overgeneral thinking has primarily been demonstrated in MDD with respect to AM retrieval (i.e., overgeneral memory, OGM), and this finding has been replicated in numerous samples of depressed and suicidal patients (Barnhofer, Jong-Meyer, Kleinpass & Nikesch, 2002; Boelen, Huntjens & van den Hout, 2013; Kuyken & Dangleish, 1995; Moore, Watts & Williams, 1988; Nandrino, Pezard, Posté, Réveillère & Beaune, 2003; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988). Overgenerality appears to persist

following depressive episodes, and has been shown in samples of currently euthymic individuals with a history of MDD or bipolar disorder (Mackinger, Loschin & Leibetseder, 2000; Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Scott, Stanton, Garland & Ferrier, 2000; Spinhoven et al., 2006), and is also evident in individuals with subclinical levels of depression (i.e., dysphoria; Goddard, Dritschel & Burton, 1997; Moffitt, Singer, Nelligan, Carlson & Vyse, 1994; Ramponi, Barnard & Nimmo-Smith, 2004).

A few studies have failed to replicate overgeneral thinking in affective disorders. For example, Dalgleish and colleagues (2001) investigated AM in Seasonal Affective Disorder (SAD), and found that participants with SAD did not generate more overgeneral memories relative to control participants. However, SAD is presumed to be a biological response to seasonal changes in levels of light (Dagleish, Rosen & Marks, 1996), whereas MDD is often precipitated by a chronic history of negative life events or adversity. This difference between SAD and MDD and the proposed underlying mechanisms of overgenerality (Williams, 2006; see *Section 1.3.4*) likely explain the failure to replicate overgeneral thinking in SAD. Despite these failures to replicate overgenerality, a meta-analysis of research investigating overgeneral thinking in affective disorders revealed an overall mean Cohen's *d* effect size of 0.94 (Williams et al., 2007), suggesting that overgeneral thinking is a robust finding in mood disorders.

In MDD, overgeneral thinking has been shown to be particularly marked for those who have experienced a history of trauma. For example, Kuyken and Brewin (1995) found that women with MDD who reported a history of sexual and/or physical abuse retrieved significantly more overgeneral AMs than women with MDD but without an abusive history. Accordingly, a number of studies have demonstrated overgenerality in post-traumatic stress

disorder (McNally, Lasko, Macklin & Pitman, 1995; McNally, Litz, Prassas, Shin & Weathers, 1994; Moradi, Abdi, Fathi-Ashtiani, Dalgleish & Jobson, 2012; Schönfeld, Ehlers, Böllinghaus & Rief, 2007), and acute stress disorder (Harvey, Bryant & Dang, 1998). In a meta-analysis of studies investigating overgenerality in trauma samples, Williams and Colleagues (2007) found a significant mean effect size of 1.13 for the association between trauma and overgeneral thinking.

Although few studies have examined reduced specificity of future thinking in MDD, the finding reported by Williams and colleagues (1996) has been replicated in a number of psychiatric populations. For example, Dickson and Bates (2006) employed the use of the AMT and FET to investigate the specificity of future thinking in dysphoria. The authors found that dysphoric individuals generated less specific past and future autobiographical events in comparison to non-dysphoric individuals. In a related study, Holmes and colleagues (2008) found that dysphoria was related to a reduction in the subjective vividness of positive (but not negative) future events. Additionally, one study found that depressed individuals exhibited less specific goals and explanations for goal attainment than non-depressed individuals (Dickson & Moberly, 2013). Overgeneral autobiographical processing has also been found in terms of imagining future events in PTSD (Brown et al., 2014; Brown et al., 2013; Kleim, Graham, Fihosy, Stott & Ehlers, 2013), complicated grief (MacCallum & Bryant, 2011), bipolar disorder (King et al., 2011), eating disorders (Dalgleish et al., 2007), and schizophrenia (D'Argembeau, Raffard & Van der Linden).

Taken together, overgenerality presents as a significant core cognitive deficit in affective disorders and has been found to be associated with impaired problem-solving skills (Goddard, Dritschel & Burton, 1996, 1997; Raes et al., 2005) and delayed recovery

(Brittlebank, Scott, Williams & Ferrier, 1993; Dangleish, Spinks, Yiend & Kuyken, 2001) in MDD.

1.3.3 Overgeneral thinking and emotional valence

Taking into account previous findings of a negative bias in the processing of autobiographical information in MDD, it would be plausible to expect overgenerality to be more evident for negative relative to positive events. However, the evidence regarding interactions of overgenerality and emotional valence is mixed (and as yet, has not been explored with respect to future thinking). For example, while some studies have reported that MDD is characterised by more overgeneral AMs in response to negative cues in comparison to positive cues (e.g., Burnside, Startup, Byatt, Rollinson & Hill, 2004; Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Park, Goodyer & Teasdale, 2004; Scott, Williams, Brittlebank & Ferrier, 1995; Watkins & Teasdale, 2004), other studies have reported more overgeneral AMs in response to positive versus negative cues (e.g., Williams & Broadbent, 1986; Williams & Scott, 1988). Furthermore, many studies have demonstrated that individuals with MDD produce OGM for all memories, irrespective of valence (e.g., Dickson & Bates, 2006; Goddard, Dritschel & Burton, 1996; Kuyken & Dalgleish, 1995; Kuyken, Howell & Dalgleish, 2006; Ramponi, Barnard & Nimmo-Smith, 2004).

King and colleagues (2010) suggest that there may be a number of clinical variables that modulate the relationship between overgeneral thinking and AM valence, including depression severity and illness burden at the time of testing. For example, Nandrino and colleagues (2003) found that unlike non-depressed individuals and patients with first episode MDD, patients with recurrent MDD produced more overgeneral responses for positive versus negative cues. However after 28 days of recovery and clinical improvement, mean

overgeneral responses to negative cues for the recurrent MDD group *increased*, flattening out the mean difference of overgeneral responses between negative and positive cues found before recovery. This finding suggests that severity of depression and burden of illness may modulate the presentation of overgenerality in MDD.

1.3.4 Mechanisms underlying overgenerality in MDD

There are a number of proposed mechanisms by which the retrieval of a specific AM can be disrupted in MDD. While much of the research in this area has focussed predominantly on AM retrieval, these mechanisms are thought to also apply to future thinking (Dickson & Bates, 2006; Williams et al., 1996), especially considering that simulating specific future events critically relies on access to episodic details (Addis & Schacter, 2012). It is generally assumed that the retrieval of AMs can occur either via a generative search process or directly accessed (Conway & Pleydell-Pearce, 2000), and it is most likely that disruptions occur during *generative retrieval*. Generative retrieval is a top-down process that utilises conceptual abstract representations to facilitate AM retrieval in response to cues that do not map directly to a specific memory (e.g., cue-words on the AMT). To begin the generative search, the retrieval process enters a cue-elaboration phase whereby mnemonic cues trigger verbal associations. For example, the verbal cue "happy" may trigger a verbal association of "my dog Lucy". Activation of this verbal concept will then ensure the retrieval process will access the autobiographical knowledge base at either the lifetime period or, most commonly, the general event level. For example, the representation of "my dog Lucy" will activate either a particular lifetime period associated with this concept (e.g., "When I lived with my parents and looked after my dog Lucy), or general event knowledge associated with this concept (e.g., "Taking Lucy for walks"). Activation then spreads throughout the autobiographical knowledge base from higher levels of abstraction, through to event specific

knowledge (i.e., episodic memory) that matches search criteria (e.g., "one day, I took Lucy to the beach for a walk and she chased the birds"). In this process of generative retrieval, executive processes are utilised to match AM search criteria to available representations, both directing the downward search process and inhibiting irrelevant representations.

In contrast, *direct retrieval* (also referred to as *pattern completion*; Marr, 1971; McNaughton & Morris, 1987) is a bottom-up process in which internal or environmental cues immediately trigger representations of event specific knowledge, bypassing higher levels of representation within the autobiographical knowledge base (i.e., lifetime periods, general events). Due to the immediate organised pattern of activation in direct retrieval, there is little need for the involvement of executive processes in the inhibition of irrelevant information. Thus, direct retrieval is rapid and there is less demand on cognitive resources to coordinate the retrieval process. Addis and colleagues (2012) found that distinct patterns of neural activity were associated with different retrieval processes. Specifically, generative retrieval was associated with early activation of lateral prefrontal and temporal regions, reflecting strategic search processes and recovery of general AM information, and later activation of the AM retrieval network. In contrast, direct retrieval was associated with faster retrieval processes, and with earlier and stronger activation of the AM retrieval network including medial temporal (particularly the left hippocampus), medial prefrontal and medial parietal regions.

In view of Conway and Pleydell-Pearce's (2000) hierarchical model of AM, the CaR-FA-X model (Williams, 2006; Williams et al., 2007) has attempted to elaborate on how disruptions to the generative retrieval search lead to overgenerality. Specifically, this model proposes three mechanisms underlying overgeneral thinking: *Capture and Rumination* (CaR),

Functional Avoidance (FA), and *impaired eXecutive control* (X). Central to this model is the mechanism of *functional avoidance*, initially proposed by Conway and Pleydell-Pearce (2000) as the core mechanism underlying overgeneral thinking. During generative retrieval, individuals appear to truncate the retrieval of specific episodic memories, by aborting the search at higher levels of representation (i.e., lifetime periods, general events). This process is referred to as *dysfacilitation*. Often, individuals who have experienced depression and/or traumatic events are likely to have event specific knowledge containing traumatic, embarrassing, and/or distressing details of previous life experiences. Given that event specific knowledge contains summary records of sensory-perceptual and affective features of experiences, which are "experience-near" in terms of phenomenological quality, dysfacilitation functions to inhibit activation of specific memories and thus avoiding potentially distressing content. In this way, dysfacilitation, and thus overgeneral thinking, can be seen as an acquired coping strategy adopted by individuals with MDD to help regulate negative affect. Initially, this behaviour may have been learned to manage negative emotions and thus adaptive in the short-term. However, with time, overgenerality can become a functional and automatic retrieval strategy, and in the long-term, lead to difficulties in accessing *all* specific episodic memories. From a learning perspective, truncating the retrieval search at higher levels of abstraction (i.e., OGM) becomes negatively reinforced by the avoidance of negative emotions (Williams et al., 2007).

Experimental evidence of functional avoidance in OGM comes from research using avoidance scales. One such scale, the Impact of Event Scale (IES; Horowitz, Wilner & Alvarez, 1979), is a 15-item questionnaire containing items to assess stress reactions and other symptoms indicative of PTSD (i.e., amount of intrusions; degree of avoidance). A number of studies have found positive correlations between the avoidance subscale of the IES

and OGM, suggesting that the higher individuals score on the avoidant subscale the more overgeneral AMs they produce (Kuyken & Brewin, 1995; Lemogne et al., 2009; Raes et al., 2006; Stokes, Dritschel & Bekerian, 2004; Wessel, Merckelbach & Dekkers, 2002). Hermans and colleagues (2005) found the OGM pattern to be positively associated with different forms of avoidance, including social-behavioural avoidance (Cognitive Behavioural Avoidance Scale; Ottenbreit & Dobson, 2004), experiential avoidance (The Acceptance and Action Questionnaire; Hayes et al., 2004), and thought suppression (The White Bear Suppression Inventory; Wegner & Zanakos, 1994). This suggests that individuals with an overgeneral pattern of memory retrieval are more avoidant in a number of different domains beyond memory per se.

If overgenerality is the consequence of truncated search and thus functional avoidance, it may be assumed that overgeneral thinking would be more prominent for negative cue-words. However, as mentioned, the findings are mixed in terms of the overgeneral thinking and cue-word valence. Williams and colleagues (2007) suggest this mixed picture may be due to other underlying mechanisms thought to contribute to overgeneral thinking – such as *rumination*. Depressive rumination is a fundamental cognitive feature of MDD (Papageorgiou & Wells, 2003), and has been found to maintain and exacerbate depressed symptomatology (Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema, 1991; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, 2000). In alignment with cognitive models of depression, depressive rumination is often characterized by emotion-related, negative self-representations or "self-schemas" (e.g., Beck 1967, 2002), which are generally in a state of heightened availability to individuals with MDD (Williams et al., 2007). According to the CaR-FA-X model, the capture and rumination mechanism underlying overgeneral thinking refers to how ruminative processes triggered by self-relevant

information “capture” attentional and other cognitive resources, resulting in insufficient capacity for the generative retrieval of a specific AM (Williams, 2006; Williams et al., 2007). This propensity of cognitive capacity to be captured by ruminative processes may increase over time, due to “mnemonic interlock” (Williams, 1996). This concept refers to how continual attempts to retrieve AMs, that are truncated and aborted at higher levels of abstraction, results in greater degrees of abstract, overgeneral content being activated. Thus, future attempts at retrieval become highly associated with the intermediate, abstract descriptions of AM, leading to the retrieval of further overgeneral descriptions rather than the retrieval of sensory-perceptual or affective ESK.

To investigate the association of rumination and OGM, a number of studies have employed the use of an experimental manipulation of ruminative thinking (Park, Goodyer & Teasdale, 2004; Watkins & Teasdale, 2001, 2004; Watkins, Teasdale & Williams, 2000). For example, Watkins, Teasdale and Williams (2000) investigated rumination on AM retrieval in a sample of dysphoric adults by randomly allocating participants to rumination or distraction conditions. In the rumination condition, participants were instructed to focus their attention on items that were internally focussed, relating to their symptoms, their emotions or perceptions of the self (e.g., “Think about what your feelings may mean”), while in the distraction condition, participants were instructed to focus their attention on items that were externally focussed (e.g., “Think about the shape of a large black umbrella). Using the AMT, the authors found significant differences in OGM between the two conditions, such that the rumination condition was associated with significantly more overgeneral responses than the distraction condition. In another study, Watkins and Teasdale (2001, 2004) were interested in investigating whether individual differences in rumination are related to overgeneral thinking. Specifically, using a rumination-induction paradigm, they examined whether having an

analytical ruminative self-focus (e.g., "Think about why you feel the way you do"), or having a more experiential ruminative self-focus (e.g., "Focus your attention on your experience of the way you feel inside") would have any impact on the specificity of AM responses. In support of the CaR-FA-X model, the authors found that in depressed participants, overgeneral thinking was higher in those engaging in analytical self-focus, but was reduced in those engaging in experiential self-focus. This finding suggests that in depression, overgeneral thinking is related to an analytical, abstract style of thinking characteristic of a ruminative self-focus, while an experiential self-focus, with attention directed towards sensory-perceptual features of current experience is associated with reduced overgenerality.

Finally, the CaR-FA-X model also proposes that an impairment in *executive functioning* is another likely mechanism underlying overgeneral thinking. As mentioned, generative retrieval involves supervisory executive processes to direct the retrieval search (i.e., selection and inhibition), as well as a number of other executive processes including planning, working memory, and set-shifting (Cabeza & St Jacques, 2007; Conway & Pleydell-Pearce, 2000; Moscovitch, 1992). Thus, deficits in these executive processes which guide the pattern of AM activation by holding AM search criteria in working memory, inhibiting irrelevant information during AM search (thus avoiding "capture" errors), and holding the final retrieval result in working memory, is likely to hinder successful episodic retrieval (Williams et al., 2007). Accordingly, the development of the ability to retrieve specific AM corresponds to the development of supervisory executive control processes, generally around the ages of three or four (Fivush & Nelson, 2004). Additionally, studies in ageing and brain damage samples suggest that memory specificity is reduced alongside impaired working memory function (Baddeley & Wilson, 1986; Williams, 1996; Winthorpe & Rabbitt, 1988).

Simulating future events also involves various components of executive function, including planning, working memory, set-shifting, selection and inhibition of information, and the integration of details (Berryhill, Picasso, Arnold, Drowos, & Olson, 2010; D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010; Schacter & Addis, 2007). In comparison to memory retrieval, there are greater demands on executive processes in future thinking due to future simulation involving the combining of autobiographical details to construct novel events (D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010; Schacter & Addis, 2007). Additionally, in comparison to retrieved events which occur in a particular spatiotemporal context, there is presumably an infinite number of ways to rearrange spatial and temporal details when constructing imagined events, placing greater demands on selection and inhibitory executive processes. Given these increased demands on executive functions in future simulation, it is possible that future events may be even more susceptible to disruption in MDD, and thus overgenerality (D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010).

1.4 Specificity scoring in cue-word paradigms

Traditionally, OGM research has adopted the use of the AMT (Robinson, 1976; Williams & Broadbent, 1988), most often using cue-words of emotional valence to elicit AMs. Conventionally, the AMT uses a three-level scoring scale for AM specificity whereby: "3" denotes an event specific to time and place; "2" denotes a specific event specific to time but general in place, and vice versa; and "1" denotes an event general or non-specific in time and place (Williams, Healy and Ellis, 1999). A potential criticism of this method for assessing AM specificity is that it is quite a coarse scale, as the rich and diverse phenomenological details comprising specific episodic events are not captured.

Another scoring approach referred to as the Autobiographical Interview (AI; Levine et al., 2002; adapted for future events by Addis, Wong & Schacter, 2008) segments and categorises AM details according to their episodicity (e.g., episodic vs non-episodic). Typically, transcripts are segmented into individual details based on having a subject and predicate (e.g., "/I dropped my sandwich/") with additional information segmented accordingly (e.g., "/I dropped my sandwich/ on the train/ last Wednesday/" = 3 details). Details are then categorised based on whether they are part of the specific event in question – that is, the main event (if one is described) that is temporally specific (in that it occurred in a 24 hour period). Details that are part of the main event are scored as "internal". All other details are external, including details that pertain to another event, that are semantic in nature, that relate to extended details (e.g., "My teenage years were horrible"), general details (e.g., "I was always late to lectures), repetitions of information, and meta-cognitive statements. Internal and external details are then tallied, and often a specificity ratio score is calculated (i.e., external/internal), whereby larger ratio scores reflect greater levels of overgenerality.

The AI has predominantly been used to examine different aspects of AM occurring in medial temporal lobe amnesia (Kirwan, Bayley, Galvan & Squire, 2008; Steinvorth, Levine & Corkin, 2005), frontal lobe pathology (McKinnon, Black, Miller, Moscovitch & Levine, 2006; McKinnon et al., 2008), Alzheimer's disease (Addis, Sacchetti, Ally, Budson & Schacter, 2009; Barnabe, Whitehead, Pilon, Arsenault-Lapierre & Chertkow, 2012), and aging populations (Addis, Musicaro, Pan & Schacter, 2010; Addis, Wong & Schacter, 2008; Levine et al., 2002; St. Jacques & Levine, 2007). There has been some recent interest in adopting the AI to investigate autobiographical events in various psychiatric populations, including schizophrenia (MacDougall, McKinnon, Herdman, King & Kiang, 2015), PTSD (McKinnon, Palombo, Nazarov, Kumar, Khuu & Levine, 2014), bipolar disorder (King et al.,

2013), and MDD (King, MacDougall, Ferris, Herman & McKinnon, 2011; Söderlund et al., 2014). Consistent with previous research of overgenerality in MDD, depressed participants exhibit a reduced ability to generate specific episodic details (e.g., internal details) in comparison to control participants for both the retrieval of past events (Söderlund et al., 2014) and the simulation of future events (King, MacDougall, Ferris, Herman & McKinnon, 2011).

Whether the constructs of *specificity* and *episodic detail* are distinct is a matter of debate. Theoretical conceptualisations of episodic memory argue that remembering a specific event requires the binding of individual phenomenological details into a coherent representation (Schacter & Addis, 2007), suggesting these constructs are closely related. This has been demonstrated experimentally by Ritchie and colleagues (2006), who showed participants' subjective ratings of the accessibility to their specific AMs and the amount of detail in those specific AMs to be highly correlated. However, it is possible that episodic specificity and detail do differ as constructs to some degree. For example, in a large population sample, Kyung and colleagues (2016) found that the proportion of specific memories and memory detail were not correlated, and in fact had different patterns of association with other variables including depressive symptoms, subjective stress, emotional reactivity, avoidance, rumination, and executive control. The authors claim that this evidence may suggest that specificity and detail are quite different constructs. However, it appears that the AM details coded by Kyung and colleagues captured *all* details generated by participants, including non-episodic details. Given that discrete phenomenological details are integrated to constitute specific events, it is likely that episodic and non-episodic details are differentially related to specificity, and thus may have different predictive pathways. For example, it is plausible that specificity would be positively correlated with episodic details, and possibly negatively correlated with non-episodic details.

1.5 Current objectives

As mentioned, there has been a shift from interest in the quantitative aspects (e.g., speed of recall) of AM in MDD to a greater focus in the quality of these memories (e.g., specificity). This research suggests that MDD is associated with overgeneral AMs, and that this tendency persists into remission. Additionally, there is growing interest in the relationship between AM and future events, and how future thinking may be associated with overgeneral thinking in MDD. In alignment with this previous research, the studies reported in this thesis investigate the quality of remembered and imagined autobiographical events in individuals who were currently depressed and/or had a history of MDD. *Study 1* examines the nature of event specificity in MDD, in both remembered and imagined events, using two different methods of capturing specificity: the AMT and the AI. Examining a different aspect of the quality autobiographical events, *Study 2* investigates the valence and content of remembered and imagined events, and the relationship of these phenomenological aspects to specificity in MDD.

Chapter 2: General Methods

2.1 Participants

Forty-nine participants in total (20 control and 29 MDD participants) were recruited from a university and community population to complete the study, which was approved by the University of Auckland's Human Participants Ethics Committee. Given that overgenerality is evident not only in individuals with current depression, but also those with remitted MDD or dysphoria, the current study did not restrict the sample of depressed participants to those currently depressed. Thus, inclusion criteria for the MDD group were a diagnostic history of MDD (i.e., a diagnosis from a GP, psychiatrist or other health professional) or a current moderate level of depression as indicated by a score greater than 19 on the Beck Depression Inventory Data (BDI-II; Beck, Steer & Brown, 1996). Exclusionary criteria for both groups included not being fluent in English, since there were verbal requirements of the experiment. Considering that age-related hippocampal atrophy begins to accelerate at age 50 (Raz et al., 2004), participants were also excluded from the study if they were not aged between 18 and 50 years. With the exception of depression and anxiety, participants were excluded from the current study if there was the presence or history of neurological and/or psychiatric conditions. We took a broad recruitment strategy, which meant that data from a total of 16 participants did not meet these criteria and were excluded from the study. Specifically, eight participants with self-reported depression were excluded as they did not meet MDD group criteria; three controls were excluded as they exhibited levels of depression in the mild-moderate range as indicated by the BDI-II (i.e., >14); two participants were excluded due to cortical abnormalities indicated by MRI scans; one participant was excluded due to a diagnostic history of post-traumatic stress disorder; one participant was excluded due to a history of substance abuse; and one participant dropped out

of the study. Consequently, 17 right-handed participants with a current moderate-severe level of depression and/or a diagnostic history of MDD, and 16 age- and gender-matched controls with no significant history of MDD or current levels of depression, were included in the current studies. Demographic information is provided in Table 1, showing that participants in the two groups were matched on age, sex and years of education. However, as expected, the control and depression groups differed significantly on the Beck Depression Inventory (BDI-II), the Beck Anxiety Inventory (BAI), the number of depressive episodes experienced, the Cognitive and Behavioural Avoidance Scale (CBAS), the Rumination Responses Scale (RRS), the Perceived Stress Scale (PSS), and the PERI life events scale.

Table 1. The demographic information and descriptive data for experimental groupings.

	Mean (SD)		*p* value
	Control Group (n=16)	Depression Group (n=17)	
Age	20.6 (2.7)	23.5 (6.4)	.104
Sex (female:male)	14:2	15:2	.676
Education (years)	15.3 (2.4)	14.8 (2.3)	.556
BDI-II	3.3 (3.6)	18.2 (11.7)	**< .001**
BAI	3.9 (2.2)	13.4 (8.8)	**< .001**
Number of episodes	0 (0)	3.1 (2.2)	**< .001**
CBAS Total Avoidance Score	54 (19.4)	90 (34.6)	**< .001**
RRS Rumination Score	3.1 (.6)	3.7 (.8)	**.03**
PSS	13.5 (7.2)	22 (8.0)	**.003**
PERI mean stressfulness	4.7 (1.5)	5.9 (1.6)	**.03**

Note: BDI-II: Beck Depression Inventory II. BAI: Beck Anxiety Inventory; CBAS: Cognitive Behavioural Avoidance Scale; RRS: Rumination Reflection Scale; PSS: Perceived Stress Scale; PERI: PERI life events scale.

2.2 Procedure

The current study forms part of a larger project aimed at investigating the different cognitive and neural aspects of MDD and so involved the collection of a vast amount neuropsychological, physiological and brain imaging data, along with the behavioural data that was analysed for the current thesis. Initially, verbal consent for participation in the study was obtained in a brief pre-screening telephone interview. If eligible, participants provided informed written consent before completing two separate sessions on two separate days.

2.3 Session One

Session one, which took approximately three hours to complete, involved the administration of a selection of self-report measures to assess various aspects of psychological functioning, including depression, anxiety, rumination, avoidance and stress (in addition to other neuropsychological tests not reported in this thesis).

2.3.1 Beck Depression Inventory II (BDI-II)

The BDI-II (Beck, Steer & Brown, 1996) is a 21-item multiple-choice self-report measure that is used to assess the severity of depression over the past two weeks. Responses are rated on a four-point scale. A total score was taken by summing item scores, whereby higher scores indicated higher levels of depressive symptoms (range 0-63).

2.3.2. Beck Anxiety Inventory (BAI)

The BAI (Beck & Steer, 1993) is a 21-item multiple-choice self-report measure that assesses the severity of anxiety over the past week. Responses are rated on a four-point scale.

A total score was taken by summing item scores, whereby higher scores indicate a greater level of anxiety (range 0-63).

2.3.3. Rumination Reflection Scale (RRS)

The RRS (Trapnell & Campbell, 1999) is a 24-item self-report measure that assesses an individual's tendency to ruminate and reflect. The RRS is comprised of a rumination subscale and a reflection subscale; both with 12-items in each. Responses are rated on a five-point scale. Trapnell and Campbell (1999) report internal consistency alpha coefficients of 0.90 and 0.91 for the rumination and reflection subscales respectively. Mean scores were taken for each subscale. The rumination subscale was the focus for the current study.

2.3.4. Cognitive-Behavioural Avoidance Scale (CBAS)

The CBAS (Ottenbreit & Dobson, 2004) is a 31-item self-report measure that is used to assess depression-related avoidance. The items of the CBAS assess an individual's use of various strategies to deal with situations and problems in their lives. Responses are rated on a five-point scale, whereby higher scores indicate greater levels of avoidance. The CBAS is comprised of four subscales (i.e., behavioural social, behavioural non-social, cognitive social, cognitive non-social) which have been demonstrated to have adequate to high internal consistency (α = .86, .75, .78, .80, respectively) and test-retest reliability (r = .86, .88, .58, .94, respectively) (Ottenbreit & Dobson, 2004). Ottenbreit and Dobson also demonstrated high internal consistency for the total scale, with a Cronbach's alpha reliability coefficient of 0.91, while test-retest reliability was 0.92. The total score across all subscales was analysed in the current study.

2.3.5. Perceived Stress Scale (PSS)

A 10-item version of the PSS was adopted in the current study to assess the degree to which situations in the life of an individual are appraised as stressful within the last month (Cohen & Williamson, 1988). Responses on the PSS are rated on a five-point scale, whereby higher scores indicate greater levels of perceived stress. The 10-item PSS has been demonstrated to have good internal consistency, with a Cronbach's alpha reliability coefficient of 0.89 (Roberti, Harrington & Storch, 2006). A total score was taken by summing item scores for each participant.

2.3.6. PERI Life Events Scale (PERI)

The PERI Life Events Scale (Dohrenwend, Krasnoff, Askenasy & Dohrenwend, 1978) is a self-report measure that assesses the occurrence and associated stress with common life experiences. Specifically, individuals indicate whether a particular event has occurred in their life, and for those which have, they rate the associated stress of the event on a 10-point scale where higher values indicate higher amounts of stress. For brevity, we used a reduced set of the original PERI items. This subset included the top-ranked events (Dohrenwend et al., 1978) and events most relevant to a New Zealand sample, comprising 61 of the 102 items from the original PERI scale. Mean stressfulness was computed across events for each participant.

2.4 Session Two

Session two, which took approximately two hours to complete, involved an MRI session whereby participants generated past and future events within the scanner. Following

the MRI session, these events were recalled during a post-scan interview. The data from this post-scan interview was used in both Study 1 and 2.

2.4.1. Past/Future Autobiographical Task

In the current study, an adapted cueing paradigm (Galton, 1879; Crovitz & Schiffman, 1974) was administered within the MRI scanner (for task instructions, see Appendix A). Specifically, in response to each event cue, participants were instructed to either remember an autobiographical event from the past (i.e., within the *last* few years), or to imagine an event which may occur in the future (i.e., within the *next* few years). Participants were given 20 seconds per event cue to generate and then elaborate on an event. A total of 48 event cues were presented (see Appendix B for list of cues). When generating these events, participants were asked to recall or imagine events that were both specific in time (i.e., occurred within a 24-hour period) and place. Participants were encouraged to remember or imagine the events using a field perspective rather than from an external observer vantage point, to help facilitate the ability to recall or imagine episodic detail (McIsaac & Eich, 2002). Following the generation of an event, participants were asked to rate on a four-point scale the amount of detail that they were able to imagine (i.e., 1 = vague with no/few details; 4 = vivid and highly detailed), and the amount of emotion associated with the event (i.e., 1 – detachment, no emotional experience; 4 = intense emotional experience).

2.4.2. Post-scan Interview

The past/future task within the MRI scanner was followed by a post-scan interview (60-90 minutes in duration) whereby participants provided descriptions of the 48 events they had generated during the cue-word task. For 12 pre-selected events (see Appendix B for the

cues for these pre-selected trials), participants were audio-recorded while providing an event description for up to two minutes; recordings were later transcribed for AI scoring. For the remaining 36 events, participants provided brief descriptions which were sufficient for AMT scoring (see *Section 3.2.1*). Participants also rated each event in terms of personal significance (i.e., 1 = low; 4 = high), perspective (i.e., 1 = first person; 2 = third person) and difficulty (i.e., 1 = no difficulty; 4 = high difficulty).

Chapter 3: Study 1 – The Specificity of Autobiographical Events in Depression

3.1 Introduction

Depression can be characterised as holding negative views of both the past and the future (Beck, 1967; 2002). While research has confirmed the presence of negative biases in memory (Bearden et al., 2006; Lloyd & Lishman, 1975; MacLeod & Byrne, 1996; Williams & Scott, 1988; Williams et al., 1996) and future thinking (Lavender & Watkins, 2004; MacLeod & Cropley, 1995; MacLeod, Tata, Kentish & Jacobsen, 1997; Miles, MacLeod & Pote, 2004) in depression, MDD studies consistently report that AM is also "overgeneral". That is, individuals with a history of depression tend to describe past events in an abstract, categorical way that lacks temporal and contextual specificity (Williams & Broadbent, 1986). Moreover, in line with the constructive episodic simulation hypothesis (Schacter & Addis, 2007a, 2007b), the future events generated by individuals with MDD are also overgeneral (Williams et al., 1996) possibly because of an impaired ability to access specific memory details (Addis & Schacter, 2012). It has been suggested that the overgeneral view of the future may impede the ability to move out of a depressed state, thereby maintaining MDD (Lavender & Watkins, 2004). Thus, it is critical to understand the nature of overgenerality in depression (and how best to measure the overgeneral quality of autobiographical events), and the association between the way the past is recalled and the future is simulated.

While there are a wealth of studies examining the nature of overgeneral thinking in MDD with regards to the recollection of past events (see Williams et al., 2007 for a comprehensive review), there are comparatively few papers examining the specificity of future events in depression (e.g., King, MacDougall, Ferris, Herdman & McKinnon, 2011; MacCullum & Bryant, 2011; Williams et al., 1996). The first study to document this was by

Williams and colleagues (1996). They employed a version of the AMT adapted to also include future events (FET), and found that suicidally depressed participants were more general than controls both in recalling past events and imagining future events. Although the number of specific past and future events were correlated suggesting depressed individuals are equally non-specific when recalling the past and imaging the future, Williams and colleagues did not directly test differences between these conditions. Thus, it is not clear whether these abilities were similarly or differentially impaired.

3.1.1 Specificity of past and future events

Interestingly, differences between the ability to generate past and future events have been found in healthy, non-depressed participants. Anderson and Dewhurst (2009) employed the use of the *Sentence Completion for Events from the Past Test* (SCEPT; Raes, Hermans, Williams & Eelen, 2007) and the *Sentence Completion for Events in the Future Test* (SCEFT; Anderson & Dewhurst, 2009), in which participants completed sentences related to past and future events. Anderson and Dewhurst found that participants were less specific when simulating future events than when recollecting past events. The authors suggest that this difference may be due the more effortful constructive demands involved in imagining the future. Considering the flexible nature in which aspects of memory are recombined to imagine the future, the generation of future events is likely to require greater cognitive flexibility and executive resources than recalling past events. Indeed, evidence from fMRI studies suggest that there is greater neural activity when generating future events than when recollecting past events (Addis, Cheng, Roberts & Schacter, 2011). Additionally, there is research to suggest that memories of past events contain more sensory and contextual details than representations of future events (Arbuthnott, Geelen & Kealy, 2002; D'Argembeau & Van der Linden, 2004; Johnson, Foley, Suengas & Raye, 1988; McGinnis & Roberts, 1996).

Taken together, this evidence suggests future events may be more difficult to construct than past events, and thus it is likely that imagining the future is more sensitive to disruption, including becoming overgeneral in MDD.

At least part of the reason why future events involve greater cognitive demand in comparison to past events is the increased role of executive functions when imagining the future in order to recombine episodic details to construct novel scenarios. According to the CaRFAX model, it is possible that reduced specificity in both past and future events may be accounted for by executive dysfunction in MDD. Previous paradigms in specificity research have predominantly used generic cue words (that do not refer to an event) to elicit responses. Specifically, the AMT employs emotional cue words (e.g., "happy", "surprised", or "sorry"). It is possible that providing external support may mitigate the impact of executive dysfunction on overgenerality in MDD, and increase specificity of past and future events. One way to investigate this experimentally would be to use cue-words that vary in their level of support.

3.1.2 Specificity scoring in cue-word paradigms

It is plausible that different methods of measuring specificity could affect the ability to detect differences in specificity between recalling the past and imagining the future. Traditionally, OGM research has used the AMT's three-level scale to score AM specificity, where events are categorised as being specific in: both time *and* place; time *or* place; or neither (Williams, Healy and Ellis, 1999). However, as mentioned, this method is relatively coarse and does not account for phenomenological details provided by participants or the semantic elements that typically comprise specific events. In response to these issues, the AI was introduced (Levine et al., 2002; Addis, Wong & Schacter, 2008). The segmentation and

categorisation of internal (i.e., episodic) and external (i.e., non-episodic) details allows for the analysis of *every detail* of the autobiographical events examined. The mean number of internal details, or the ratio of internal to external details, provide overall measures of the episodic specificity of events.

As mentioned, the AI has been utilized to investigate autobiographical events in MDD (King, MacDougall, Ferris, Herdman & McKinnon, 2011; Söderlund et al., 2014). For example, King and colleagues (2011) found that depressed participants generated future events with fewer internal details than controls, but there was no group difference in external details. In a more recent study, Söderlund and colleagues (2014) found that depressed participants generated significantly less internal details than controls for past events. Additionally, while the authors found that depressed participants also generated less external details than controls, this finding did not reach significance (d = 0.60, p = .08). There have currently been no studies using the AI which have compared past and future events in MDD.

Another nuance of the AI, apart from segmenting episodic and non-episodic content, is that internal and external details can be subcategorised based on type (see *Section 3.2.2*). Specifically, there are internal detail subcategories for event details, place, time, perceptions, thoughts and emotions, while for external details, there are subcategories for semantic information, extended events (e.g., "My teenage years were horrible"), categorical events (e.g., "I was always late to lectures), repetitions, and meta-cognitive statements. Using these subcategories enables an even more fine-grained analysis of whether changes in particular types of details may be contributing to overgenerality. This approach could be particularly important in understanding overgenerality, given findings suggesting that certain detail types might be most affected by depression. In a non-clinical sample, Bywaters and colleagues

(2004) found depressed mood to be associated with increased imagery vividness for picture recall, irrespective of the emotional valence of the stimuli. In a study of prospective imagery (i.e., future simulation), Holmes and colleagues (2008) found depressed mood to be associated with reduced vividness of positive prospective imagery, but increased vividness of negative prospective imagery. Currently, the relationship between depressed mood and types of details produced in remembered and imagined events, and in turn the role this plays in reduced event specificity, remains unclear. However, it is likely that the AI will prove useful in understanding overgenerality in MDD. Indeed, using the AI approach, Söderlund and colleagues (2014) found that the overall reduction in internal details in depressed relative to control participants was accounted for by significant reductions in event, time, perceptual and thought/emotion details. As yet, this particular scoring approach has not been applied to examining future events.

3.1.3 The current study

In the current study, we explored the nature of specificity of both remembered and imagined events in a sample of individuals with current and/or past experience of depressive symptoms. Our first aim was to replicate previous findings (e.g., Williams et al., 1996) suggesting a relationship between the specificity of future and past events. In alignment with the constructive episodic simulation hypothesis, and the proposed central role of episodic memory to both processes of imagining and remembering, the proportion of future events classified as specific using the AMT scoring criteria will be correlated with specificity proportions for past events. Given previous findings, it is hypothesized that the specificity of future events will be positively related to the specificity of past events.

Our second aim was to examine specificity in the depression and control groups using both the AMT and the AI scoring methods of specificity. In alignment with previous research, it is hypothesized that the control group will exhibit more specific past and future events than the depression group. Specifically, given the increased cognitive demand involved constructing future events relative to past events, it is hypothesized that group differences in specificity will be particularly marked for future events. Furthermore, an investigation of the types of details affected will provide greater detail as to what kind of details may be underlying overgenerality in MDD. Thus, it is hypothesized that relative to the depression group, the control group will generate significantly more details in the internal detail subcategories, particularly those subcategories associated with autonoetic consciousness such as event, time, perceptual and thought/emotion details. Again, given the hypothesised increased difficulty of projecting into the future, it is likely that any group differences will be exaggerated for future events relative to past events.

Our third aim will be to compare the AMT and the AI scoring methods of measuring event specificity to investigate whether the AI provides a more nuanced approach to investigating overgenerality in MDD. It is hypothesized that, even when only examining events considered specific in time and place on the AMT, AI scoring will still reveal differences in specificity (i.e., internal details) between the depression and control groups. If this is the case, it would be an indication that the AI is a more sensitive index of overgenerality.

3.2 Methods

Events recalled during the post-scan interview were scored to reflect the degree of specificity using two different methods: The AMT scoring method was applied to the

descriptions obtained for all 48 trials; and for the 12 audio-recorded events, the adapted AI scoring method was also used.

3.2.1 Autobiographical Memory Test (AMT) Specificity Scoring

Based on the brief descriptions provided for all 48 event-cues during the post-scan interview, participant responses were scored to reflect the degree of specificity. In alignment with AMT scoring criteria (Williams, Healy and Ellis, 1999), event responses were scored using a 3-scale whereby events specific in both time and place received a "3"; events specific in either time or place received a "2"; events which were not specific in time and/or place (i.e., personal semantics) received a "1".

3.2.2 Adapted Autobiographical Interview (AI)

Transcribed events were scored in alignment with adapted AI scoring criteria (Addis, Wong & Schacter, 2008; Levine, Svoboda, Hay, Winocur & Moscovitch, 2002; see Appendix C for the Autobiographical Interviewing scoring manual). To score events, a central event was first identified. Responses were then segmented and categorised as either internal (i.e., details pertaining to a specific event) or external. The transcripts were also scored to identify the *types* of details generated (Levine, Svoboda, Hay, Winocur & Moscovitch, 2002). Internal details were separated into five subcategories (e.g., event, time, place, perceptual, thought/emotion), and external details were separated into five separate categories (e.g., semantic, repetitions, other, external episodic, external generic). For each participant, the number of details in the internal/external categories, and in every detail subcategory were tallied. Event scores for each category/subcategory were then averaged across the 12 events provided.

The internal and external scoring was conducted by a rater blind to group membership. Reliability of this scorer with four other raters was established using a training set of 20 past and future events taken from a previous study (Addis et al., 2008). An intraclass correlation analysis demonstrated acceptable inter-rater reliability, with Cronbach's alphas of 0.95 for internal scores and 0.91 for external scores. Additionally, Cronbach's alphas for AI detail categories were all at acceptable levels: 0.89 for event details, 0.85 for place details, 0.90 for time details, 0.97 for perceptual details, 0.87 for emotion/thought details, 0.83 for semantic details, 0.74 for repetition details, 0.85 for other details, 0.79 for other episodic details, and 0.79 for general details.

3.3 Results

3.3.1 Autobiographical Memory Test (AMT) Specificity Scoring

In alignment with aim 1, we were interested in investigating event specificity as captured by the AMT scoring method. Due to some events being omitted because participants were unable to provide a response, the mean number of events included in the analysis for the control group (Future: $M = 22.63$, $SD = 1.89$; Past: $M = 23$, $SD = 1.26$) and depression group (Future: $M = 22.29$, $SD = 1.10$; Past: $M = 21.94$, $SD = 1.92$) varied slightly, but was not statistically significant for either future or past events (p values $> .05$).

We were first interested in replicating previous work (e.g., (Williams et al., 1996) suggesting a relationship between the specificity of past and future events. In accordance with the AMT scoring method, event responses were only scored as a '3' when they were specific to both time and place, and the proportion of specific future events was then correlated with the proportion of specific past events to investigate whether this relationship exists. Across

experimental groups, the proportion of specific events provided for past and future event cues were found to be significantly correlated, $r(33) = 0.52$, $p = .002$. Interestingly, this correlation appeared to be driven by a large significant relationship for the depression group between the proportion of specific events provided for past and future events cues, $r(17) = 0.54$, $p = .026$, while there was no significant relationship for the control group, $r(16) = 0.005$, $p = .99$.

Also in alignment with aim 1, we were further interested in investigating whether event specificity changes as a function of condition and group. In order to examine group differences in event specificity, the proportion of specific events were analysed using a 2 (Condition: Future, Past) × 2 (Group: Control Group, Depression Group) mixed factorial ANOVA with a repeated factor of condition and a between-subjects factor of group. As predicted, there was a significant main effect of group on event specificity, $F(1, 31) = 8.60$, $p = .006$, such that overall, the control group produced a greater mean proportion of specific events in comparison to the depression group. There was also a significant main effect of condition, $F(1, 31) = 18.94$, $p < .001$, with participants producing a greater proportion of specific events in the past condition in comparison to the future condition. Critically, there was also significant condition x group interaction, $F(1, 31) = 6.38$, $p = .017$. Pairwise comparisons using the Fisher LSD[1] test revealed that the group difference in event specificity was significantly marked in the future condition (*Mean diff.* = 0.127, $p = .007$), but did not reach significance in the past condition (*Mean diff.* = 0.025, $p = .074$), suggesting that the group difference was driven more by future than past events (see Figure 1).

[1] Fisher LSD tests are appropriate when the number of pairwise comparisons does not exceed three (Howell, 2013)

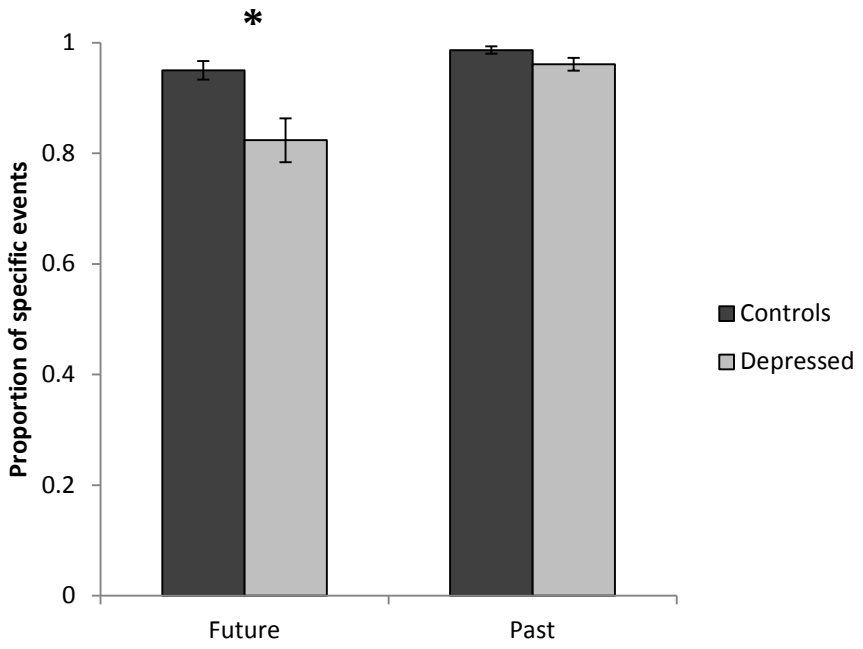

Figure 1. The mean proportion of specific event responses as a function of condition and group. Error bars reflect standard error of the mean. *$p < .05$.

It is possible that overgeneral events may be most evident during episodes of depression; on the other hand, overgenerality may be a persistent, trait-like characteristic of individuals with a history of depression and thus evident during remission. To explore this possibility, we divided the depressed sample into two groups: Currently depressed (i.e., BDI-II >19; $N = 7$) and not currently depressed (i.e., BDI-II <19; $N = 10$). To determine whether the events generated by these subgroups differed in specificity, the proportion of specific events were analysed using a 2 (Condition: Future, Past) × 2 (Group: Currently Depressed, Not Currently Depressed) mixed factorial ANOVA. No significant main effect of group, $F(1, 15) = 1.99$, $p = .18$, or group x condition interaction, $F(1, 15) = 1.68$, $p = .22$, were found. Additionally, we did not find a meaningful relationship between severity of current depression (i.e., BDI-II scores) and the proportion of specific events ($r(33) = -0.19$, $p = .29$).

3.3.2 Adapted Autobiographical Interview (AI)

Past and future event responses were scored in accordance with the adapted AI criteria to give counts of internal and external details that participants provided for each event. A small proportion of events generated were omitted (e.g., inapplicable within-scanner data; omission at post-scan). Thus, the mean number of events included in this analysis for controls and depressed participants was 5.12 (*SD* = 1.2) and 4.53 (*SD* = 1.12) respectively for the future condition, and 5.62 (*SD* = 0.62) and 5.12 (*SD* = 0.86) respectively for the past condition. In order to examine group differences in event specificity, a 2 (Condition: Future, Past) × 2 (Detail Category: Internal, External) × 2 (Group: Control Group, Depression Group) mixed factorial ANOVA with repeated factors of condition and detail and a between-subjects factor of group was conducted. There was a significant main effect of condition, $F(1, 31) = 41.96$, $p < .001$, demonstrating that participants provided more details in the past condition in comparison to the future condition. There was also a significant main effect of detail $F(1, 31) = 108.28$, $p < .001$, whereby participants provided more internal details than external details, suggesting that participants were following the requirements of the task. There was also a significant condition x detail interaction effect $F(1, 31) = 22.97$, $p < .001$. Pairwise comparisons using the Fisher LSD test indicated that significantly more internal details were provided by participants for the past versus the future condition ($p < .001$), in comparison to external details where there was no effect of condition ($p = .286$) (see Figure 2). There was no main effect of group, $F(1, 31) = 0.16$, $p = .576$. Importantly, however, there was a significant detail x group interaction effect $F(1, 31) = 4.99$, $p = .033$. Pairwise comparisons using the Fisher LSD test revealed a crossover interaction whereby the direction of the group difference was reversed for internal detail versus external detail. Specifically, the control group (*M* = 14.74, *SD* = 4.41) produced more internal details than the depression group (*M* =

12.82, *SD* = 4.41), while the depressed group (*M* = 7.41, *SD* = 3.03) produced more external details than the control group (*M* = 6.39, *SD* = 3.02) (see Figure 3). The condition x detail x group interaction was not significant $F(1, 31) = 0.03$, $p = .864$.

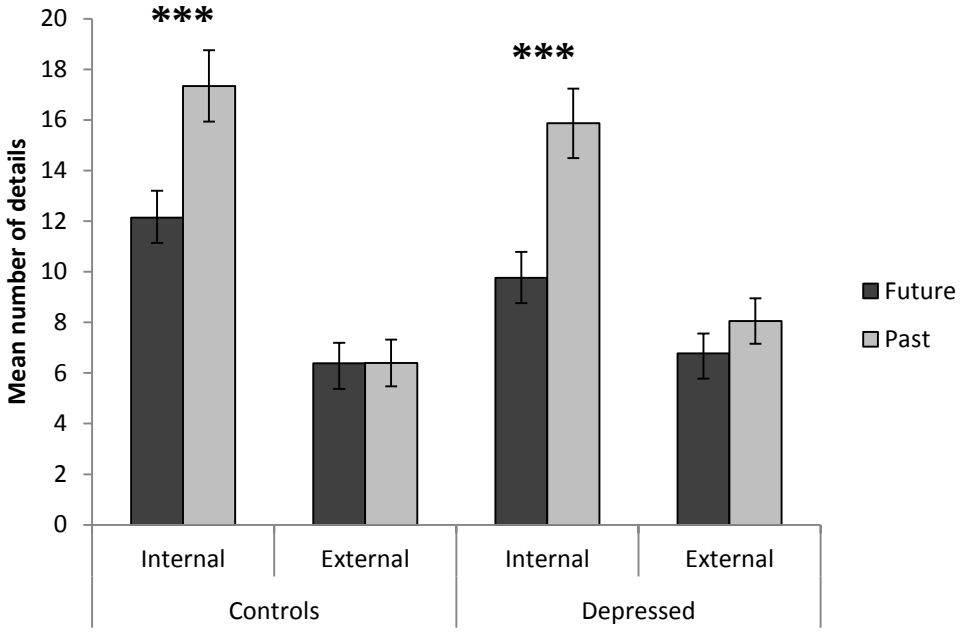

Figure 2. The mean number of internal detail as a function of condition, detail category and group. Error bars reflect standard error of the mean. ***$p < .001$.

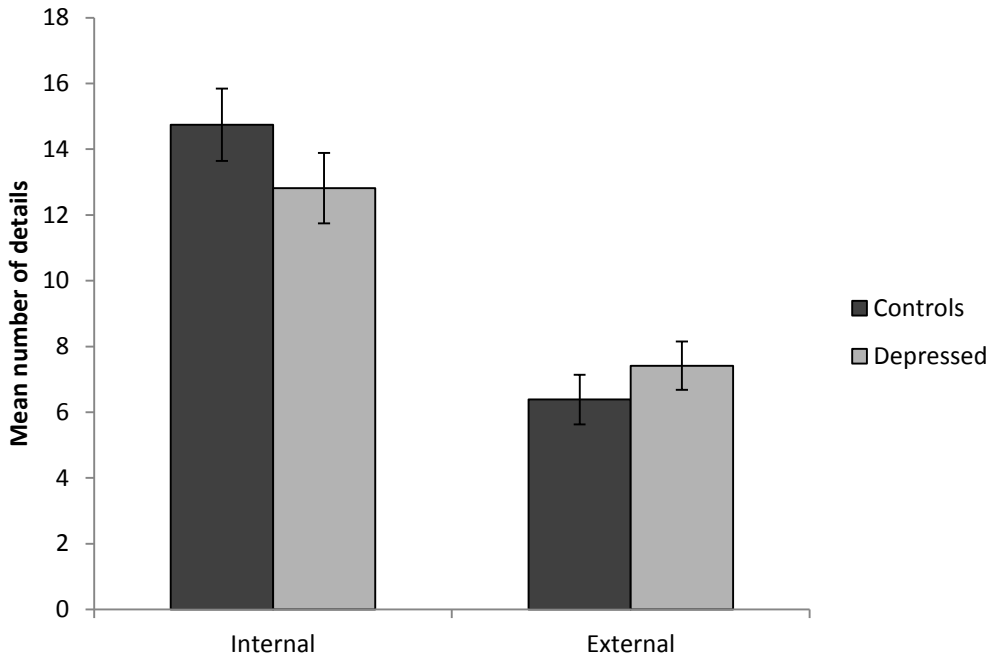

Figure 3: The mean number of details as a function of detail category and group. Error bars reflect standard error of the mean.

To further investigate the specific types of details affected by overgenerality, internal and external details were categorised based on type of detail as defined by AI scoring criteria. In order to examine group differences in the types of details participants provided, a 2 (Condition: Future, Past) × 10 (Detail Type: event, time, place, perceptual, thought/emotion, semantic, repetitions, other, external episodic, external generic) × 2 (Group: Control Group, Depression Group) mixed-factorial ANOVA with repeated factors of condition and type and a between-subjects factor of group was conducted. Mauchley's test indicated that the assumption of sphericity had been violated for the main effect of type, $\chi^2(44) = 187.69$, $p < .001$, and for the type x condition interaction effect, $\chi^2(44) = 110.36$, $p < .001$. Therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .39$ for main effect of type and .54 for interaction effect of type x condition). As reported above,

there was a significant main effect of condition, $F(1, 31) = 41.11$, $p < .001$, indicating that participants provided more details for the past condition in comparison to the future condition. As expected, there was also a significant main effect of type, $F(3.52, 108.96) = 113.98$, $p < .001$, suggesting that there was a significant difference between the types of details provided by participants, with the majority of details. There was also a significant type x condition interaction effect, $F(4.84, 149.95) = 10.84$, $p < .001$. Pairwise comparisons using the Fisher LSD test indicated that the main effect of condition was driven primarily by differences in internal detail types. Specifically, participants provided a greater number of details in the past condition in comparison to future condition for all internal detail types (all $p < .05$), whereas there was no effect of condition for any external detail types. Critically, there was a significant type x group interaction effect, $F(3.52, 108.96) = 4.31$, $p = .004$. Bonferroni-corrected[2] pairwise comparisons indicated that a significantly greater amount of internal "event" details were provided by the control group in comparison to the depression group ($p = .003$), while the depression group generated significantly more external "other" details in comparison to the control group ($p = .003$) (see Figure 4).

[2] A Bonferroni correction is appropriate when the number of pairwise comparisons exceeds three (Howell, 2013)

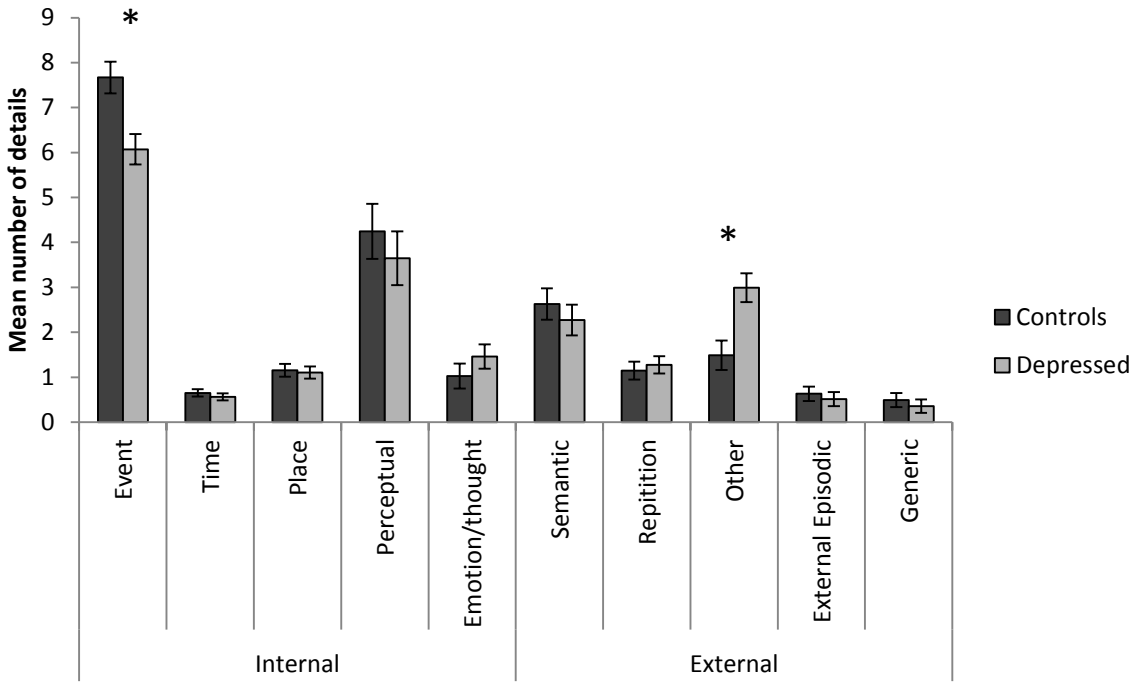

Figure 4: The mean number of details as a function of detail type and group. Error bars reflect standard error of the mean. *$p < .05$.

3.3.3 Comparing the AMT and Adapted AI Scoring Methods

In alignment with aim 3, the current study also set out to compare two methods of scoring event specificity: the AMT and the adapted AI. Data going into these analyses were limited to those AMT trials for which AI data was also collected. Firstly, correlation analyses were conducted to examine the relationships between the measures of specificity resulting from the AMT and AI. In order to provide an analogous AI measure to the AMTs specificity score (i.e., the proportion of total events that were specific), we computed the proportion of AI *internal*-to-total details, reflecting the amount of specific episodic information generated by participants. We found a significant *positive* correlation between the proportion of specific events (i.e., AMT) and the proportion of AI internal detail, $r(33) = 0.49$, $p = .004$. We also

computed proportion of AI *external*-to-total details, reflecting the amount of non-episodic information generated by participants. Not surprisingly, we found a significant *negative* correlation between the proportion of specific events (i.e., AMT) and the proportion external detail (i.e., AI), $r(33) = -0.49$, $p = .004$. These relationships were expected considering that internal details reflect specific episodic content, whereas external details reflect non-episodic content.

However, despite this association between the AMT and AI scoring methods, we examined more directly whether there were any differences between the two methods in capturing event specificity. In other words, are specific events (as scored by the AMT) equivalent across groups in terms of episodic specificity (as measured by AI internal details). To this end, we analysed a subset of the trials in which events scored a "3" ("specific") on the AMT *and* there was AI data available. The AI data were then entered into a 2 (Condition: Future, Past) × 2 (Detail: Internal, External) × 2 (Group: Control Group, Depression Group) mixed factorial ANOVA with repeated factors of condition and detail and a between-subjects factor of group. The findings of this ANOVA revealed a similar pattern to the AI findings provided for aim 1 (see *Section 3.3.2*). For example, there was still evidence of a significant main effect of condition (Past>Future, $F(1, 31) = 38.35$, $p < .001$); a significant main effect of detail (Internal>External, $F(1, 31) = 133.10$, $p < .001$), and a significant condition x detail interaction effect, $F(1, 31) = 20.37$, $p = .002$. Post-hoc comparisons using the Fisher LSD test revealed that a significantly greater amount of internal details were provided by participants for the past condition versus the future condition ($p < .001$), in comparison to external details where there was no effect of condition ($p = .346$). Although there was no main effect of group, $F(1, 31) = 0.12$, $p = .729$, critically there was a trend towards a detail x group interaction effect $F(1, 31) = 3.44$, $p = .073$. Given we had an *a priori* prediction regarding this

interaction, we inspected this trend more closely, revealing a crossover interaction whereby the direction of the group difference reversed for internal detail in comparison to external detail. Specifically, the control group (M = 14.87, SD = 4.35) generated more internal details than the depression group (M = 13.42, SD = 4.35), while the depression group (M = 7.24, SD = 3.13) generated more external details than the control group (M = 6.31, SD = 3.13).

3.4 Discussion

3.4.1 Specificity of Autobiographical Events

In alignment with previous research using the AMT (e.g., Brittlebank, Scott, Williams & Ferrier, 1993; Kuyken & Dalgleish, 1995; Kuyken, Howell & Dalgleish, 2006; Moore, Watts & Williams, 1988; Nandrino, Pezard, Posté, Réveillère & Beaune, 2003; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988), the depression group in the current study overall generated significantly fewer specific autobiographical events in response to event cues, in comparison to the control group. The evidence from the current study is striking considering that the depression group in this study were not as severely depressed as the patient and community samples recruited in many other studies (e.g., Brittlebank, Scott, Williams & Ferrier, 1993; Kuyken & Dalgleish, 1995; Moore, Watts & Williams, 1988; Nandrino, Pezard, Posté, Réveillère & Beaune, 2003; Williams & Scott, 1988). Specifically, the depression group in the current study was a heterogeneous group characterised by a history of MDD and/or a current moderate level of depression as indicated by the BDI-II (>19), and approximately half of the sample were not currently depressed at this level of severity. This finding suggests that overgenerality may present as a core deficit of MDD even when in remission. A number of other studies have found this overgeneral pattern to occur in currently euthymic individuals with history of MDD or bipolar depression

(Mackinger, Loschin & Leibetseder, 2000; Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Scott, Stanton, Garland & Ferrier, 2000; Spinhoven et al., 2006). Previous research has also found that OGM occurs in individuals with subclinical levels of depression (i.e., dysphoria) (e.g., Goddard, Dritschel & Burton, 1997; Moffitt, Singer, Nelligan, Carlson & Vyse, 1994; Ramponi, Barnard & Nimmo-Smith, 2004). In accordance with this literature, a question that has often been raised within MDD research is whether overgenerality of autobiographical events represents a state or trait marker of depression. It has been argued elsewhere (e.g., Brittlebank, Scott, Williams & Ferrier, 1993) that evidence of overgeneral thinking in individuals with a history of MDD in a current state of remission (i.e., euthymic) suggests that OGM is not merely an epiphenomenon of the state of depression, but may be a trait characteristic of individuals who have a propensity for persistent depression.

The findings from the current study may tentatively support the notion that overgeneral thinking represents a trait characteristic for vulnerability to the onset of depression rather than a particular epiphenomenon of the state of depression. Specifically, there was no significant difference in the specificity of events generated by depression group participants who were currently depressed or in remission. Moreover, the correlation between BDI-II scores and specificity was not significant. However, a degree of caution should be taken in making this assertion. It is difficult to say with any certainty that overgeneral thinking represents a trait characteristic for vulnerability to the onset of depression. For example, it has been argued that it is potentially erroneous to assume trait characteristics (i.e., cognitive vulnerability prior to depressive episodes) for depression using evidence from remitted depression studies (Just, Abramson & Alloy, 2001). Given that these studies do not assess participants prior to the onset of depression, the impact that depressive symptoms may have had on cognition and memory following depressive episodes is not taken into account. It

is quite possible that depressive illness has some causal relationship with overgenerality (i.e., scar hypothesis; see Lewinsohn, Steinmetz, Larson & Franklin, 1981). Indeed, proposed mechanisms underlying overgenerality (i.e., CaRFAX; Williams, 2006) suggest this to be the case.

Additionally, while overgeneral thinking is often viewed as a cognitive deficit because of its association with ineffectual problem solving (Goddard, Dritschel & Burton, 1996; Pollock & Williams, 2001), it is possible that a lack of specificity has some protective benefits. In alignment with a functional view of overgenerality (i.e., CaRFAX; Williams, 2006; Williams et al., 2007), Raes and colleagues' (2003) *affect regulation hypothesis* suggests that reduced specificity may be an adaptive strategy that helps individuals mitigate the negative affect associated with negative experiences. Thus, rather than being an incidental strategy, overgenerality can be functionally utilised in a very strategic way. Hermans and colleagues (2004) suggest that it is likely the majority of people employ this non-specific strategy flexibly, modulating in and out of general and specific patterns of thinking in response to mood states and other internal and external cues. Indeed, a small number of studies employing a mood induction paradigm have demonstrated that inducing negative mood, in comparison to neutral and positive mood induction, results in a decrease in AM specificity in non-depressed individuals (Maccallum, McConkey, Bryant & Barnier, 2000; Svaldi & Mackinger, 2003; Yeung, Dalgleish, Golden & Schartau, 2006). It is possible that some individuals lose the ability to flexibly modulate specific and non-specific autobiographical process, possibly as the result of traumatic life events and/or severity of depression, and become stuck in a habitual pattern of non-specific processing, thus employing an overgeneral strategy globally. Accordingly, it is feasible that overgenerality, while maladaptive within a depressive episode by stifling effective problem-solving and affect-

regulatory strategies, may be relatively adaptive while in remission. Spinhoven and colleagues (2006) investigated memory specificity in a sample of individuals in remitted depression, and did not find memory specificity to be related to the duration of remission, nor was it related to the number of relapses, mean severity of relapses, duration of relapses, or the course of depressive symptoms at 24-month follow-up. Thus, the role of specificity of autobiographical events in remission, and the nature of overgeneral thinking as a state or trait marker in MDD, remains unclear.

The depression group in the current study was also found to be significantly less specific in their event responses in comparison to the control group as indicated by the AI scoring method. Overall, the pattern of findings found using the AI were broadly consistent with those found using the AMT. The group difference in specificity was indicated distinctly by a crossover interaction, whereby the control group generated more episodic (internal) details than the depression group, whereas the depression group generated more general (external) event details than the control group. In light of previous research on overgenerality in MDD, this interaction would be expected considering that internal details reflect more specific episodic features of events, whereas external details reflect more general, extended and/or semantic features of events. This interaction was driven by the control group generating significantly more internal "event" details in comparison to depression group, while the depression group generated significantly more external "other" details in comparison to the control group.

This crossover interaction pattern of AI results found in the current study has also been shown in a sample of individuals with PTSD (Brown et al., 2013), and samples of ageing adults, mild cognitive impairment and frontotemporal dementia (Addis, Musicaro, Pan

& Schacter, 2010; Addis, Wong & Schacter, 2008; Levine, Svoboda, Hay, Winocur & Moscovitch, 2002; Madore, Gaesser & Schacter, 2013; McKinnon et al., 2008; Murphy, Troyer, Levine & Moscovitch, 2008). Addis and colleagues (2010) suggest that in older adults, the greater production of external details relative to younger adults may be related to age-related deficits in executive control. Deficits in executive control are also commonly found in depressed samples (McDermott & Ebmeier, 2009).

Similarly, Söderlund and colleagues (2014) found that depressed participants recalled significantly fewer internal details than control participants. However, in contrast to the current study, depressed participants also generated fewer external details in comparison to control participants; although this difference was not statistically significant. With regards to types of details, Söderlund and colleagues found that depression participants recalled significantly fewer event, time, perceptual and thought details relative to the control group. Conversely, in the current study the depression group only exhibited a deficit in event details, with an increase in "other" details relative to the control group. The differential pattern of results found between that of Söderlund and colleagues and the current study may reflect differences in the samples used. For example, the depressed sample used by Söderlund and colleagues were severely depressed patients who had been referred for electro-convulsive therapy. It is likely that severe depressive symptoms have a profound and wide-ranging effect on the cognitive abilities underlying memory specificity (see McDermott & Ebmeier, 2009 for a meta-analysis). It is plausible that less severely depressed individuals with greater cognitive resources, such as those in the depression group in the current study, may still be able to supplement a reduction in specific episodic detail with increased verbal content (i.e., non-specific detail). This may be reflected in the greater "other" details produced by the depression group in the current study in comparison to controls, a category that includes

metacognitive statements and editorializing. Therefore, the greater "other" details produced by the depression group relative to the control group may be a verbal reflection of the difficulty participants in our depression group had in generating specific events. What may also account for the differential pattern of results across these studies is the difference in the number of events used. It may be the case that the greater number of events used by Söderlund and colleagues resulted in greater cognitive and memory fatigue for depressed participants, particularly in a highly acute depressed sample who are likely experiencing significant limitations to cognitive resources. Overall, however, both the AMT and AI scoring methods used in the current study indicate that, in a less severely depressed sample of participants, reduced specificity of past and future events is clearly evident, although there may be some forms of compensation in terms of increased verbal output.

3.4.2 Remembering and Imagining

Overall, we found that participants in the current study generated more specific past events in comparison to future events. Such phenomenological differences between remembered and imagined events are commonly found in the general population. For example, in a sample of healthy adults, D'Argembeau and Van der Linden (2004) found that participants provided more detailed representations of past events relative to future events. It is likely that differences in the subjective experience of past and future events play a crucial role in helping individuals differentiate between the recollection of actually experienced events, and other cognitive experiences such as imagined events, beliefs or dreams (D'Argembeau & Van der Linden, 2004).

A number of previous studies have demonstrated that impairments in the recall of episodic memory are associated with impairments in simulating specific future events (Addis,

Wong & Schacter, 2008; Hassabis & Maguire, 2007; Klein, Loftus & Kihlstrom, 2002; Tulving, 1985). As suggested by Schacter and Addis (2007), the simulation of future events relies on the ability to access details recalled from past events, and use them in novel and flexible ways to imagine new scenarios. In alignment with their constructive episodic simulation hypothesis, the current results support the presence of an overgeneral thinking style in MDD that affects the ability to both recall the past and imagine the future. This finding may also reflect the relationship between the past and the future denoted by cognitive models of MDD; namely that depression is characterised by cognitively biased perspectives of the past, which also affect perspectives of the future (Beck, 1967; 2002). Considering this relationship between AM retrieval and future thinking, it is likely that overgeneral thinking in MDD inhibits access to autobiographical content which prevents its utilisation by future simulation processes. It is plausible that this global restricted access to autobiographical information also impedes processes that may facilitate recovery from a depressive episode, including the retrieval of positive events to help regulate low mood (Anderson, Boland & Garner, 2015) or the setting of specific goals and perception of goal attainment (Belcher & Kangas, 2014; Dickson & Moberly, 2009), thus contributing to the perpetuation of depressive symptoms in MDD.

In alignment with aim 1, we were also interested in whether group differences in specificity similarly affected recalling the past and simulating the future. While Williams and colleagues (1996) also reported a reduction in the specificity of future events in MDD, as well as a significant correlation between the numbers of specific past and specific future events, they did not *directly* compare the mean proportions of specific future versus past events. In the current study, a direct comparison of the proportions of specific future and past events (as scored by the AMT) revealed that this reduced specificity is more pronounced when

depressed individuals attempt to imagine the future in comparison to when they recall the past. In fact, although trending, we did not replicate previous findings suggesting a significant difference in the proportion of specific *past* events between the depression and control groups (e.g., Barnhofer, Jong-Meyer, Kleinpass & Nikesch, 2002; Boelen, Huntjens & van den Hout, 2013; Kuyken & Dangleish, 1995; Moore, Watts & Williams, 1988; Nandrino, Pezard, Posté, Réveillère & Beaune, 2003; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988). The overall group difference in specificity was driven primarily by *future* events. This may be explained by the use of supportive cues in the current study, which provided sufficient support to ameliorate the overgenerality of past events. Indeed, concrete cue words are generally more effective at eliciting AMs in comparison to abstract cue words (Rubin & Schulkind, 1997)

A number of other studies have also found reduced specificity of future simulation in affective disorders (King et al., 2011). For example, King and colleagues (2011) investigated the specificity of future simulation (but not memory recall) in bipolar disorder using the AI. Similar to the current study, individuals with bipolar recalled fewer internal details than controls. Reductions in the specificity of future events in affective disorders likely reflect the additional cognitive demands required when simulating future events. Specifically, the flexible recombination of events to form novel future simulations require greater involvement of executive functions and working memory, which are likely not required to the same degree when recalling the past (D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010; Schacter & Addis, 2007). Previous research suggests that deficits in executive function are common in individuals who experience depression (McDermott & Ebmeier, 2009). Although not within the scope of this study, we could speculate that impairments to working memory and executive functions, which are also required for AM retrieval and possibly more

profoundly for future simulation, may account for the differences between past and future specificity found here. Additionally, although past events can be recalled either directly or via a generative retrieval processes (Conway and Pleydell-Pearce, 2000), as Anderson and Dewhurst (2009) argue, future simulation will always involve an effortful, constructive process analogous to generative retrieval. Thus, the simulation of future events is inherently more demanding of cognitive resources compared to the recollection of past events.

Interestingly, the pattern evident in the AMT data was not reflected in the AI data, as there was no condition x detail x group interaction. Specifically, the pattern of results (see Figure 2) suggested that *both* controls and depressed participants produced more internal details (i.e., episodic detail) when remembering the past relative to the imagining the future. One explanation of this differential finding between the AMT and the AI scoring methods is that the AI is a more fine-grained approach at capturing specific episodic detail. For example, event specificity is captured in a dichotomous way using the AMT (i.e., specific vs. non-specific). In contrast, using the AI allows for a richness and diversity in episodic detail of autobiographical events and thus may reveal differences not apparent when using the AMT. It is also possible that this difference is explained by the fact that trials going into the AI analysis were only a subset of the trials going into the AMT analysis.

3.4.3 Specificity Scoring Methods

To address aim 3, we compared the AMT and AI methods of assessing specificity. The results of the correlation analyses suggest that AI internal details are meaningfully related to the generation of specific events as captured by the AMT. This relationship was expected since both remembering and imagining involve the integration of phenomenological details to form a coherent specific event (Schacter & Addis, 2007). Additionally, the negative

correlation between the proportion of specific events as captured by the AMT and the AI external detail scores suggests that external details may provide a useful index of the propensity for overgenerality.

While AMT and AI specificity measures were correlated, there was also tentative evidence to suggest they capture different aspects of specificity. The subset of AI trials analysed in the current study (see *Section 3.3.3*) were all classified as specific in time and place by the AMT scoring method. Thus, for this subset of events, the groups were completely matched for AMT specificity. However, when scoring these events with the AI, the predicted group x detail interaction almost reached significance (p = .073) reflecting the presence of group differences in AI specificity. Although interpretations based on these data are tentative, it does suggest that despite being specific on the AMT, the events generated by the two groups nevertheless differed in terms of their episodic *content*. It is likely that the AI captures aspects of episodic specificity that the AMT simply cannot because it allows for a more descriptive qualitative account of individuals experiences. In doing so, the AI provides a more fine-tuned, nuanced approach to examine specificity. It has been argued by some researchers that the AMT may not be sufficiently sensitive to detect deficits in memory specificity (e.g., Anderson & Dewhurst, 2009; Raes, Hermans, Williams & Eelen, 2007); the current results would support this notion, as the group difference in specificity for the past event condition was not significant (although this may have been related to the use of supportive event-type cues in this study that are not standard for the AMT). Anderson and Dewhurst (2009) suggest that this is because the AMT may not adequately reveal habitual patterns of overgenerality, as individuals who normally employ an overgeneral strategy may be able to override this strategy when required by the task at testing, but slip back into a habitual overgeneral thinking in their everyday lives. This may be particularly evident with

higher functioning, non-clinical samples. With its more fine-grained and rigorous approach in examining specificity, the AI has the potential to ameliorate these concerns by helping researchers explore the particular nature of details that constitute participants' responses, and tease out the more subtle aspects of overgeneral thinking.

Bearing in mind that an advantage of the AI is that it allows a more fine-grained and detailed approach to examine autobiographical events, we were interested in exploring this possibility further by examining other qualitative features of autobiographical events generated by this depression group. Thus, Study 2 re-analysed these data to determine whether there were group differences in *phenomenological* content, and to see if specificity plays a significant role in thematic event content.

Chapter 4: Study 2 – The Content of Autobiographical Events in Depression

4.1 Introduction

Autobiographical memory (AM) is thought to be fundamental to how we construct and preserve a sense of self or identity (Robinson, 1986). In turn, how we encode and retrieve AM is contingent on the emotions, motivations and personal goal structure of the self (Conway & Pleydell-Pearce, 2000). Moreover, AM and the self are critical to how we may think about or predict the future (Buckner & Carroll, 2007; Conway & Pleydell-Pearce, 2000; Schacter & Addis, 2007b). Given the interaction between these various processes to help maintain a coherent sense of self (Conway, 2001), it may be of no surprise that contemporary theories regarding AM suggest that remembering (like future thinking) is a selective and reconstructive process, vulnerable to numerous distortions and biases (Conway, 2005; Johnson, 2006; Schacter, 1999; Schacter & Addis, 2007b). Generally speaking, it is likely that in healthy individuals, distortions in AM and future thinking adaptively help aid the preservation of a consistent positive sense of self (Albert, 1977; Taylor & Brown, 1988). However, distortions of AM and future thinking can also be maladaptive and may in fact maintain depressive symptoms. In this study, different aspects of autobiographical events are explored to determine whether past and future events are biased towards particular kinds of event content or emotions, and whether these are associated with specificity.

4.1.1 Event-content

Previous memory research has primarily focussed on different theoretical aspects of autobiographical memory, including structure (Eichenbaum & Cohen, 2004; Fink et al., 1996; Squire, 2004), organisation (Conway & Pleydell-Pearce, 2000; Rubin, 2002; Tulving, 1972;

2002), the nature of retrieval (Addis, Moscovitch, Crawley & McAndrews, 2004; Levine et al., 2002; Berntsen, 1998; Schacter & Addis, 2007b), development (Fivush, 2011), and more recently, the quality of AM (i.e., specific vs. general; Williams et al., 2007). Interestingly, one particular neglected area of AM research is the *content* of AMs. There are a small number of studies that have examined event content in both AM and future thinking (D'Argembeau, Comblain & Van der Linden, 2003; D'Argembeau & Van der Linden, 2004). For example, in a community sample, D'Argembeau and Van der Linden (2004) found that participants generated positive past and future events that involved going to parties, leisure activities, relationship episodes (e.g., romantic episodes), and work/school episodes; and negative past and future events that involved accidents, illness, death of loved ones, relationship episodes (e.g., break-ups, arguments). In another study, Schlagman and colleagues (2006) performed a content analysis on involuntary AMs generated by younger and older adults. Interestingly, they found that younger adults generated significantly more involuntary AMs about "accident/illnesses", "stressful events" and "conversations" in comparison to older adults, while older adults generated significantly more "travelling/journey" episodes in comparison to younger adults. Thus, the authors replicated prior research (e.g., Carstensen, Pasupathi, Mayr & Nesselroade, 2000) suggesting a positivity effect in the content of remembered events in older adults. To our knowledge, there have been no similar studies investigating the content of remembered or imagined events in individuals experiencing depression. In *Study 1* (see *Section 3*), we unpacked the events that our participants generated into particular details according to the Autobiographical Interview (AI) coding scheme (Levine et al., 2002). We were further interested in examining qualitative differences in the content of autobiographical events in depressed individuals in comparison to healthy controls.

4.1.2 Event valence

While prior research has largely neglected autobiographical content in depression, one area of AM content that has received some degree of scrutiny is that of emotional content and valence. The link between memory and emotion was suggested as early as the 19th century, when William James proposed that "an experience may be so exciting as to almost leave a scar on the cerebral tissue" (1890, p. 670). Since then, the large body of evidence that has accrued suggests that emotional arousal enhances the encoding of memories (Anderson, Yamaguchi, Grabski & Lacka, 2006; Bradley, Greenwald, Petry & Lang, 1992; Cahill & McGaugh, 1995; Buchanan, Etzel, Adolphs & Tranel, 2006; Kesinger, Brierley, Medford, Growdon & Corkin, 2002; Kesinger & Corkin, 2003). The release of stress hormones during episodes of emotional arousal may play a significant role in modulating this effect (Kensinger, 2009; Wolf, 2008). Given that emotional states allow attention to be guided towards crucial and relevant features of an organism's surroundings, facilitating appropriate reactions to the environment (Fredrickson & Branigan, 2005; Keltner & Gross, 1999; Lemerise & Arsenio, 2000); it would appear adaptive that memory is enhanced for environmental conditions that evoke emotional arousal (Hamann, 2001). For example, the retrieval of memories of negative emotional valence may help with the identification of threat in the environment (Plutchik, 1984). There is support for this notion experimentally, with healthy adults showing better memory for words of emotional valence in comparison to neutral words (Kensinger & Corkin, 2003; Monnier & Syssau, 2008).

While the adaptive benefits of emotional valence are quite clear, the relationship between emotion and memory is still somewhat unclear. For example, research suggests that in the general population, there is a positivity bias in AM, such that individuals exhibit better memory for positive events in comparison to negative events (Beebe-Center, 1932; Lishman,

1972; Rapaport, 1943; Ritchie et al., 2006; Walker, Vogl & Thompson, 1997). In a sample of healthy individuals, Walker and colleagues (1997) found that while the emotional intensity of all remembered events diminish over time, unpleasant emotions fade more rapidly than pleasant emotions. This is referred to as the *Fading Affect Bias* (FAD; Walker, Skowronski & Thompson, 2003), whereby the negative affect associated with AM reduces overtime, while the positive affect associated with AM is comparatively preserved. The authors suggest that FAD is likely a reflection of how remembering functions, in part, to regulate-emotion by preserving a positive sense of self (Walker & Skowronski, 2009). Furthermore, D'Argembeau and Van der Linden (2004) found individuals provided more sensorial and contextual details for positive memories relative to negative memories. There is some indication that this positivity bias effect in memory may increase with age. For example, Charles and colleagues (2005) found that in comparison to younger adults, older adults exhibited better memory for positive stimuli relative to negative stimuli. The authors suggest that alongside evidence suggesting improved emotion-regulation with age (e.g., Carstensen, Pasupathi, Mayr & Nesselroade, 2000), there may be a greater prioritisation of emotion regulation as people age, and thus a greater investment in strategies that facilitate positive affect and/or a positive sense of self.

There is also research suggesting that a positivity bias is evident for future thinking (Berntsen & Jacobsen, 2008; D'Argembeau & Van der Linden, 2004; Newby-Clark & Ross, 2003). For example, a number have studies have found an *optimism bias* in future thinking in the general population, whereby healthy individuals overestimate the likelihood of positive events, and underestimate the likelihood of negative events (Sharot, 2011; Sharot, Korn & Dolan, 2011; Weinstein, 1980). Similarly, Berntsen and Jacobsen (2008) found that participants had more positive and idyllic imagined events, in comparison to remembered

events. Additionally, D'Argembeau and Van der Linden (2004) found that participants provided more phenomenological detail and a greater sense of "pre-experiencing" for positive imagined events in comparison to negative imagined events. Furthermore, in a community example, MacLeod & Conway (2007) found that positive future thinking, related specifically to the self, was associated with subjective and psychological well-being, suggesting that the recall of positive AM may play an important role in helping with mood regulation.

Although this positivity effect of both retrieved and imagined events is commonly found in community samples, there are a number of variables that potentially modulate this effect. For instance, in comparison to healthy adults, differences in emotional memory are common in many forms of psychopathology, particularly in affective disorders.

4.1.3 Emotional valence of autobiographical events in depression

A major factor in the development of depression is the impact of prior aversive life events and experiences (Kendler, Karkowski & Prescott, 1999; Kessler, 1997). As such, cognitive theories of depression propose that MDD is characterised by a *negative cognitive triad*, consisting of negative views of the self, of the world and of the future (Beck, 1967). Accordingly, there is now a wealth of evidence suggesting that in comparison to healthy controls, individuals experiencing depression exhibit not only increased access to negative stimuli, but also impairments in memory for positive stimuli (Burt, Zembar & Niederehe, 1995; Lloyd and Lishman, 1975; Ridout, Astell, Reid, Glen & O'Carroll, 2003).

MDD is also associated with biases in the emotional valence of future-directed thinking (Bjärehed, Sarkohi & Andersson, 2010; Lavender & Watkins, 2004; MacLeod & Byrne, 1996; MacLeod & Copley, 1995; MacLeod & Salaminiou, 2001; MacLeod, Tata,

Kentish & Jacobsen, 1997; Miles, MacLeod & Pote, 2004). As a clinical construct, this aspect of depression is often referred to as "hopelessness", and indeed is a component of the diagnostic criteria for MDD (APA, 2013). A number of studies have shown that hopelessness in depression is associated with suicidal intent (Salter & Platt, 1990; Wetzel, Margulies, Davis, & Karam, 1980), parasuicidal behaviour (Petrie, Chamberlain & Clarke, 1988), and completed suicides (Beck, Brown, Berchick, Stewart & Steer, 2006; Beck, Brown & Steer, 1989). Interestingly, a common finding in the literature is that future thinking in depression appears to be characterised by limited access to positive perceptions of the future, rather than an overall increase in negative perspectives of the future (MacLeod & Byrne, 1996; MacLeod & Conway, 2007), although a few studies report more negative future events over the short term (Macleod, Pankhania, Lee & Mitchell, 1997; Bjärehed, Sarkohi & Andersson, 2010). Even so, the reduced ability to generate positive future events has been associated with depression severity (MacLeod and Salaminiou, 2001) suggesting this deficit plays an important role.

4.1.4 Specificity and emotional valence of autobiographical events

As mentioned in Study 1 (see Chapter 3), another common finding with regards to AM in depression is the reduced specificity of both remembered and imagined events (Williams et al., 2007). Given that at least one proposed mechanism underlying reduced specificity of autobiographical events is the avoidance of negative affect that may be associated with unpleasant memories (e.g., CaR-FA-X; Williams, 2006), it is plausible that depressed individuals would exhibit reduced specificity particularly for negative events to facilitate mood regulation. Although given the pattern of AM retrieval commonly found in depressed samples mentioned above (i.e., increased access to negative AMs and decreased access to positive AMs), it may also be possible that depressed individuals would exhibit

more specific negative AMs, but comparatively less specific positive AMs, possibly due to cognitive processes which preserve coherency of a negative self-narrative or reflect a mood-congruency effect (Williams et al., 2007). Accordingly, the evidence regarding the specificity and emotional valence of AM in depression is mixed.

For example, a number of studies have found that depressed individuals generate more overgeneral AMs in response to positive relative to negative cue-words (Bergouignan et al., 2008; Moore, Watts & Williams, 1988; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988); while a number of studies have found the opposite (Burnside, Startup, Byatt, Rollinson & Hill, 2004; Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Park, Goodyer & Teasdale, 2004; Ridout, Dritschel, Matthews & O'Carroll, 2016; Scott, Williams, Brittlebank & Ferrier, 1995; Watkins & Teasdale, 2004). Furthermore, some studies have demonstrated that depressed individuals produce overgeneral AMs for all memories, irrespective of valence (e.g., Dickson & Bates, 2006; Goddard, Dritschel & Burton, 1996; Kuyken & Dalgleish, 1995; Kuyken, Howell & Dalgleish, 2006; Lemogne, Piolino, Friszer & Jouvent, 2006; Ramponi, Barnard & Nimmo-Smith, 2004; Young, Erikson & Drevets, 2012) suggesting that an overgeneral strategy may affect all autobiographical events, thus becoming non-functional and maladaptive.

4.1.5 The current study

In the current study, we were interested in exploring the valence and event-content of remembered and imagined events in MDD. Our first aim was to examine whether the depression group differed from the control group in terms of the types of event content they generate in response to neutral event-cues, and to see if this content differed as a function of temporal direction. Given this constitutes a gap in prior research, it is difficult to say if there

will be differences in the content of events. Thus, this aspect of the current study is exploratory in nature. Given some of the differences in the emotional valence and specificity of both remembered and imagined events found in depressed samples relative to healthy controls, it is likely that differences in event content may also exist. We hypothesized that the depression group would generate more negative "health/illness" episodes than controls (e.g., accidents, illness and death of loved ones) and fewer positive "leisure" episodes involving pleasurable activities (e.g., holidays, social events, or sport activities).

Our second aim was to investigate whether the depression group differed from the control group in terms of the emotional valence of events generated in response to event cues, and to see if this differs as a function of temporal direction (i.e., past vs. future). In terms of emotional valence, we hypothesized that the depression group will generate fewer positive past and future events in comparison to the control group, based on previous research demonstrating a negative bias in memory recall (Burt, Zembar & Niederehe, 1995; Lloyd and Lishman, 1975; Ridout, Astell, Reid, Glen & O'Carroll, 2003) and future thinking (Bjärehed, Sarkohi & Andersson, 2010; Lavender & Watkins, 2004; MacLeod & Byrne, 1996; MacLeod & Salaminiou, 2001). Given that future thinking in MDD is characterized predominantly by limited access to positive events (rather than greater access to negative events), it is hypothesized that the depression group will generate more negative past events in comparison to the control group, but no difference in negative future events.

Our third aim was to investigate whether the emotional valence and the content of events generated by the depression and control groups differed as a function of specificity and temporal direction. As mentioned, research is mixed showing depressed individuals exhibit overgenerality for positive, negative and sometimes both positive and negative cues.

However, on balance, most studies indicate the overgeneral pattern in MDD is most evident for negative relative to positive events (Williams et al., 2007). Thus, it is hypothesized that the depression group in the current study will generate more specific positive relative to negative events. Additionally, given evidence suggesting that healthy adults generate greater phenomenological intensity and detail (and thus specificity) for positive relative to negative events (D'Argembeau & Van der Linden, 2004), it is hypothesized that the control group will exhibit a positivity bias in terms of specific events generated.

4.2 Method

A content analysis was performed by two independent coders (CM and GT) on the 12 audio-recorded events (i.e., six past events; six future events) collected for each participant (see *Section 3.2.2*) to examine the emotional valence (i.e., neutral, mixed, positive, negative) of each event. While positive and negative events included events that were clearly either positive or negative based on subjective indicators of emotional valence (i.e., use of emotion words), mixed events included events with a mixture of positive and negative subjective indicators of emotional valence, and neutral events were those with no indicators of emotional valence. This content analysis also examined five predetermined event-content categories (Leisure activities/events; Relationship episodes; Work/Academic episodes; Health/Illness episodes; and 'Other' events; adapted from D'Argembeau and van der Linden, 2004). Each event was classified as belonging to (1) one valence category, and (2) one event-content category (see Appendix D for the coding guidelines). Both coders scored the entire data set, and an inter-rater reliability analysis on content codes was performed using the Kappa statistic to determine consistency among the two independent coders for the frequency of events falling into the valence and event-content categories. The two coders demonstrated substantial agreement (Landis & Koch, 1977) in the frequency of events falling into valence

categories (Kappa = 0.65, $p < .001$) and event-content categories (Kappa = 0.66, $p < .001$). Due to this substantial agreement, only the scored data set from one coder (GT) was used in the current analyses. Frequency counts of events in each emotional valence and event-content subcategory were then tallied across the 12 events for every participant in each experimental group (i.e., control group; depression group). Although the task required participants to provide six future and six past events during the post-scan interview, some participants were unable to provide responses for all twelve trials. As such, the mean number of events included in the analysis for control and depression group participants was 5.63 (*SD* = 0.72) and 5.82 (*SD* = 0.39) respectively for the future condition, and 5.81 (*SD* = 0.54) and 5.71 (*SD* = 0.77) respectively for the past condition. Given the variable number of events generated by participants, the frequencies of event content categories were converted into percentages for the event content analysis (Section 4.3.1). The frequencies of event content and event valence categories were converted into proportions for ANOVAs (Sections 4.3.2, 4.3.3, and 4.3.4).

4.3 Results

4.3.1 Content analysis

To give an idea of the content of events generated by participants, Table 2 shows the percentages of events generated by the control and depression group falling into the five predetermined event-content categories adapted from D'Argembeau and van der Linden (2004): leisure activities, relationship episodes, work/academic episodes, health/illness episodes, and 'other' episodes.

Table 2: The percentages of events by content category and experimental groups.

	Percentage		
Event-content category	***Control group* (*n* = 16)**	***Depression group* (*n* = 17)**	***Total* (*n* = 33)**
Leisure activities	38.2%	36.2%	37.2%
Relationship episodes	34.4%	37.2%	35.9%
Work/academic episodes	18.6%	15.8%	17.1%
Health/illness episodes	4.4%	3.6%	4.0%
'Other' episodes	4.4%	7.2%	5.8%

Leisure activities: Participants provided a range of events that were categorized as leisure episodes. Many of these events involved travel; social events like going to parties or out to dinner; and sporting activities like running or snowboarding. The vast majority of leisure events were positive events (52%):

> *"It was crazy sunny, it was the day before Christmas Day I think… then, we had the perfect blue sky, yeah. Ah it was good, loving it. Charcoal cooked [BBQ]."* [control group participant].

Over a quarter leisure episodes were emotionally neutral (26%):

> *"Yeah and I just imagined myself on the plane and just looking out the window as I went over Australia."* [control group participant]

A small minority of leisure episodes were negative events (11%):

> *"Um, I was just, just in a foul mood. And I think we must have been driving down to my Mum's place, and I was just, I was just in a right foul*

mood. I don't remember the music we had on, but we did have music on." [depression group participant]

or a mixture of positive and negative valence (11%):

"Everything we tried to do just didn't work, so we ended up just like going to the supermarket and getting like salad and rolls and stuff…and eating, like eating on his deck and like having a picnic there. It was, yeah. It was raining and it was cold. Just drove around for ages trying to decide what we should do. It was still fun". [control group participant]

Relationship episodes: Participants provided a range of events that were categorized as relationship episodes. Many of these events involved relationships with family members, partners, and friends. Interestingly, the majority of the relationship episodes were emotionally neutral events (42%):

"I thought about going to visit my mum's friends. They're older people, Ray and Jerry, and we went to visit them at their house in Auckland, because they also have one on Waiheke and I remember, um, Ray bringing out pikelets and that they had nesting tables" [control group participant]

Over a quarter the relationship episodes were positive events (28%) involving themes like connection, gratitude and romance:

"Our first kiss was down at the waterfront, yeah. Um, we'd been putting it off for ages and… it's kind of really like a spur of the moment thing. Yeah it was kind of cute" [control group participant]

Another quarter of relationship episodes were negative (25%), involving themes of disconnection, disappointment and betrayal:

> *"Um that one was the last phone call I ever had with my ex-boyfriend, and it was just about, um… talking about how he had lied and... um, yeah. And yeah, and he was just lying to me but, um, and I knew it, but, you know."* [control group participant]

However, only a small minority of relationship episodes were of a mixture of positive and negative emotional valence (16%):

> *"Even though we used to be close friends and it just… we talk and it just wasn't the same quality of conversation that it used to be and it made me feel a bit sad, but I wasn't too worried about it because I understood that we all change with time and some of us don't change at all."* [depression group participant]

Work/academic episodes: Participants provided a range of events that were categorized as work or academic episodes. Almost a third of work/ academic episodes were emotionally neutral events (29%) consisting of day-to-day aspects of work or school/university:

> *"Um, I imagined going back to work this summer and my friend Ashley, who also happens to be my boss, coming in and making sure everyone was doing what they're supposed to do on a really busy day."* [control group participant]

Many work/academic episodes were negative (28%), involving themes of worry, shame and failure:

> *"I remember because we were looking at the computer…um, and then the call came in and having to double click on it to answer the call…in just my normal welcome, which is: "Hello, this is Lifeline." Um, and kind of feeling that anxiety over what was the call gonna be about, how was the call gonna go, was I gonna say the right things."* [control group participant]

A quarter of work/academic episodes were positive (25%), involving themes of competence and achievement:

> *"Okay, um, I just got my bachelor's degree and my parents came up to Auckland for the graduation. Is that prizegiving? Yeah, and I'm picturing myself in the gown and feeling really proud of myself."* [depression group participant]

A smaller number of work/academic episodes were of a mixture of positive and negative emotional valence (18%), which often involved a combination of themes of achievement and worry:

> *"Um, I just did one and I was scared that I would rip the cord or the dog would actually start twitching or something…while he was unconscious. And, um, a scary feeling but it was really cool afterwards. He asked me if I wanted to do another stitching and I'm like, "No it's okay I'll just watch." And that was a good feeling."* [control group participant]

Health/illness episodes: Participants provided a range of events that were categorized as health or illness episodes. Many of these events involved car accidents, hospital visits and death of loved ones. The vast majority of health/illness episodes were negative (80%):

> *"I was an inpatient every weekend they'd let me out to stay the weekend with my family. But I didn't really like going either way, like to home or to the hospital because… like even when I do go home I feel really depressed and I wouldn't wanna do anything with the family or anything, I just wanna stay in my room and sleep or just do nothing."* [depression group participant]

The remaining health/illness episodes were equally divided between positive (6.7%):

> *"I was asking them how much my glasses were gonna cost and then she told me they were free. So I was very excited about that."* [control group participant]

neutral (6.7%):

> *"I just had a... have an imagery of um smashing into another car, which sort of flip and causing a big crash, yeah. Um, yeah and sort of seeing, you know maybe seeing it in slow motion, sort of unfolding in front of me at high speed."* [depression group participant]

and a mixture of positive and negative emotional valence (6.7%):

> *"…he was sick and me and my sister we were just holding hands saying, "Oh he's sick", and he was very grumpy and crying [laughter], um, yeah."* [control group participant]

<u>'Other' episodes</u>: Participants provided a range of 'other' events that did not fit the above pre-specified event-content categories. The majority of these events were neutral in emotional content (68%):

"Oh, I was imagining a very cold day, um, and very thick snow; and sort of a bare tree up in the distance with snow on the branches, kind of like a dead tree but probably just not you know, in blue obviously winter." [depression group participant]

Almost a quarter of these 'other' episodes were negative events (23%):

"I had an image of walking up just by the hotel there and having a new… like quite a new flash phone, and dropping it in the puddle, in a puddle in the gutter and being very unhappy about, um, about destroying a new phone." [depression group participant]

A minority of 'other' episodes were positive (4.5%):

"I was a bit more mature; like I was dressed in like, you know, have nice clothes. Kind of a nice dress." [control group participant]

or a mixture of positive and negative emotions (4.5%):

"…this very nice lady in a white dress with blue polka-a-dots was watching Zeppelin at the bus stop for me [laughter], yeah, she was very nice, she was like, "I'll watch him. I'm fine." [laughter] So yeah, it was very kind of stressful and quite a relief that it managed to get stuck in a tree." [control group participant]

4.3.2 Group differences in event content

To examine group differences in event content, the proportions of events falling into event content categories were entered into a mixed factorial ANOVA comprising within-subject factors of Event Content (Leisure, Relationship, Work/Academic, Health/Illness,

Other) and Condition (Future, Past), and a between-subject factor of Group (Control Group, Depression Group). Mauchley's test indicated that the assumption of sphericity had been violated for the main effect of Event Content, $\chi^2(9) = 22.97$, $p = .006$, and for the condition x event content interaction effect, $\chi^2(9) = 37.47$, $p < .001$. Therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .76$ for main effect of event-content, and .59 for the condition x event content interaction). There was a significant main effect of event content, $F(3.03, 93.80) = 71.75$, $p < .001$, suggesting that overall, the events were not evenly distributed across the event content categories. Specifically, Bonferroni-corrected pairwise comparisons indicated that the highest proportion of events were leisure activities ($M = 0.37$, $SD = 0.13$) and relationship episodes ($M = 0.36$, $SD = 0.11$) in comparison to all other categories (p-values $< .001$), while there were significantly higher proportions of work/academic episodes ($M = 0.17$, $SD = 0.09$) in comparison to both health/illness episodes ($M = 0.04$, $SD = 0.06$; $p < .001$) and 'Other' events ($M = 0.06$, $SD = 0.09$, $p < .001$) (see Figure 5). The condition x event content interaction fell short of significance, $F(2.36, 73.10) = 2.32$, $p = .096$, $p = .096$.

We were also interested in investigating the role of specificity on the content of autobiographical events. The main and interaction effects reported above also held when only analysing specific events. Interestingly, however, there was a significant condition x specificity x event content interaction, $F(3.01, 93.27) = 5.73$, $p = .001$. Bonferroni-corrected pairwise comparisons indicated that among specific events, there was a significantly higher proportion of *past* relative to *future* relationship episodes generated ($p = .003$), while among non-specific events, there was a significantly higher proportion of *future* relative to *past* relationship episodes ($p = .001$) and 'other' episodes ($p = .048$) generated (see Figure 6).

Figure 5: The proportion of events falling into event content categories, collapsed across experimental groups. ***p < .001; **p<.01; *p < .05.

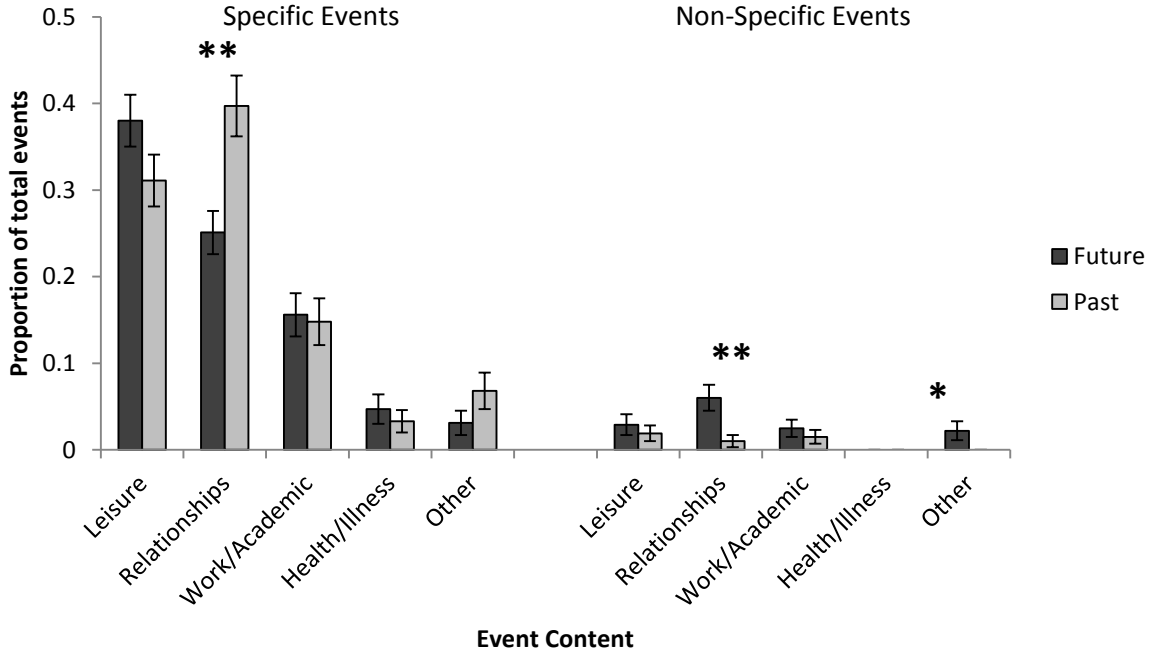

Figure 6: The proportion of events falling into event content categories as a function of specificity and condition, collapsed across experimental groups. ***p < .001; **p<.01; *p < .05.

4.3.3 Group differences in event valence

We examined group differences in valence by entering the proportions of events falling into valence categories into a mixed factorial ANOVA comprising within-subjects factors of Valence (Neutral, Mixed, Positive, Negative) and Condition (Future, Past), and a between-subjects factor of Group (Control Group, Depression Group). There was a significant main effect of valence, $F(3, 93) = 6.93$, $p < .001$, suggesting that the content of participants' events varied significantly in terms of valence. Specifically, Bonferroni-corrected pairwise comparisons indicated that overall, participants produced significantly more positive ($M = 0.34$, $SD = 0.18$) and neutral ($M = 0.30$, $SD = 0.21$) events in comparison to mixed events ($M = 0.14$, $SD = 0.14$; $p < .001$ and $p = .03$ respectively), while there was a trend towards more positive events in comparison to negative events ($M = 0.22$, $SD = 0.14$, $p = .096$) (See Figure 7).

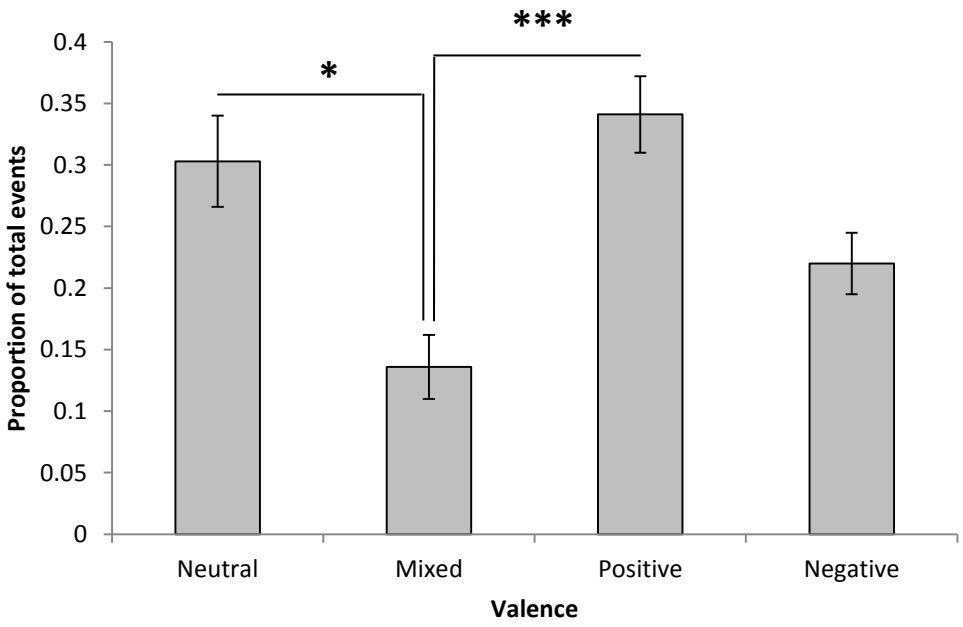

Figure 7: The proportion of events falling into valence categories, collapsed across experimental groups. ***$p < .001$; **$p<.01$; *$p < .05$.

There was a significant condition x valence interaction effect, $F(3, 93) = 5.63$, $p = .001$. Bonferroni-corrected pairwise comparisons indicated that significantly more future events were neutral ($p = .04$) and positive ($p = .03$) relative to past events, and significantly more past events were mixed ($p < .001$) relative to future events, while there was no future/past difference in terms of negative valence ($p = .15$) (see Figure 8). There was a trend towards the predicted valence x group interaction although this did not reach significance, $F(3, 93) = 2.26$, $p = .086$. Given prior evidence suggesting that, in comparison to healthy individuals, depressed individuals have greater access to negative memories but reduced access to positive memories (e.g., Lloyd & Lishman, 1975; Williams & Scott, 1988), we ran planned Bonferroni-corrected contrasts across groups for each valence category (i.e., simple effects). These tests revealed that the control group generated a higher proportion of positive events ($M = 0.41$, $SD = 0.18$) in comparison to the depression group ($M = 0.28$, $SD = 0.18$, $p = .04$), and the depression group generated a higher proportion of negative events ($M = 0.28$, $SD = 0.14$) in comparison to the control group ($M = 0.16$, $SD = 0.14$, $p = .02$). There were no group differences in terms of neutral ($p = .90$) or mixed ($p = .66$) events (see Figure 9). Additionally, the control group generated higher proportions of positive ($M = 0.41$, $SD = 0.18$) relative to negative events ($M = 0.16$, $SD = 0.14$, $p = .006$), whereas the depression group exhibited no differences in the proportions of positive and negative events generated ($p > .05$) (see Figure 9).

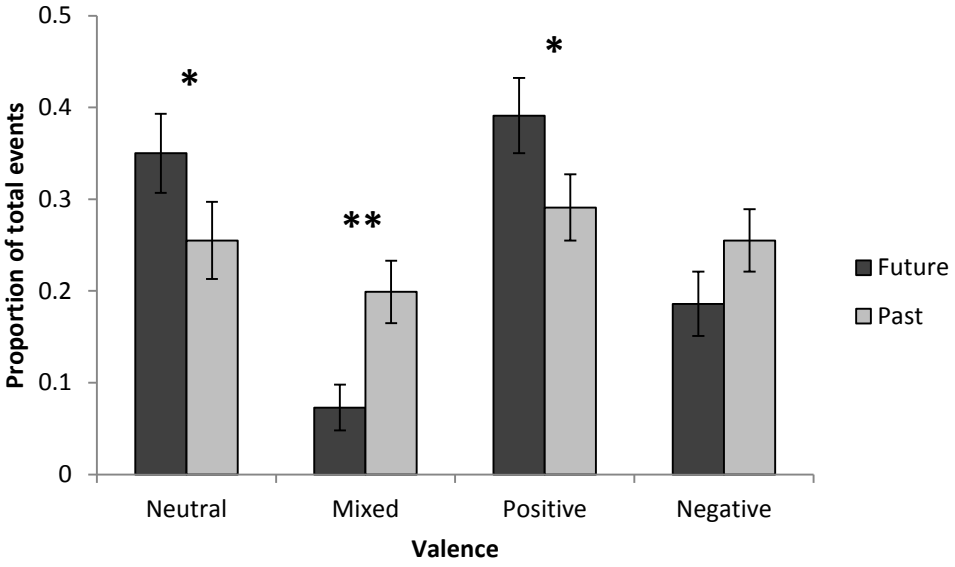

Figure 8: The proportion of events falling into valence categories as a function of condition, collapsed across experimental groups. ***$p < .001$; **$p<.01$; *$p < .05$.

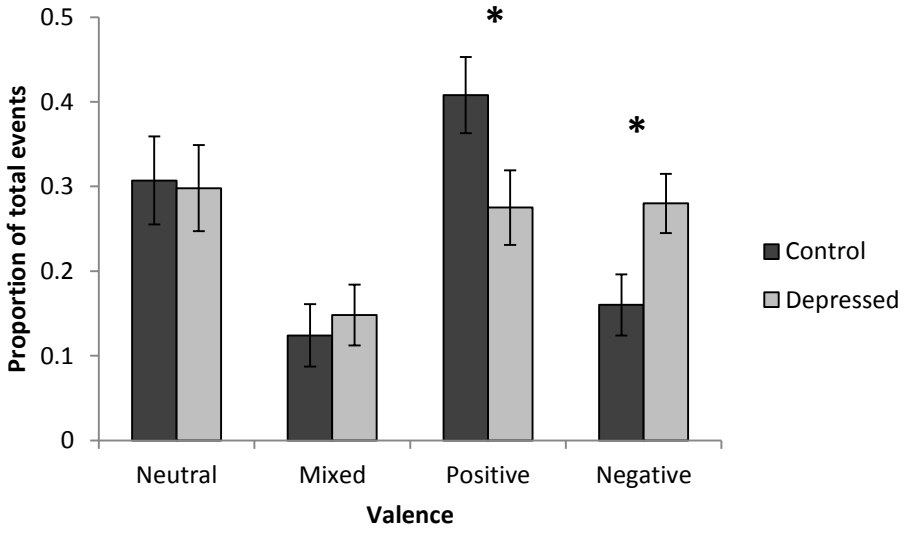

Figure 9: The proportion of events falling into valence categories as a function of experimental group, collapsed across conditions. ***$p < .001$; **$p<.01$; *$p < .05$.

We were also interested in investigating the role of specificity on the valence of autobiographical events. The main and interaction effects reported above also held when only analysing specific events. Crucially, however, this analysis revealed a significant specificity x valence x group interaction, $F(3, 93) = 2.71$, $p = .049$. Bonferroni-corrected pairwise comparisons indicated that, for specific events, the control group generated a significantly higher proportion of positive events in comparison to the depression group ($p = .015$), while the depression group generated a marginally significant higher proportion of negative events in comparison to the control group ($p = .068$). For non-specific events, the depression group generated a significantly higher proportion of neutral events ($p = .021$) and a marginally significantly higher proportion of negative events ($p = .054$) in comparison to the control group (see Figure 10). There was also a trend towards a condition x specificity x valence interaction, $F(2.38, 73.72) = 2.72$, $p = .063$, reflecting that for specific events, there was a significantly higher proportion of mixed events produced in the past condition ($M = 0.20$, $SD = 0.20$) relative to the future condition ($M = 0.06$, $SD = 0.13$, $p < .001$). However, for non-specific events, there was a significantly higher proportion of neutral events in the future condition ($M = 0.08$, $SD = 0.12$) relative to the past condition ($M = 0.03$, $SD = 0.07$, $p = .027$), and a higher proportion of positive events in the future condition ($M = 0.03$, $SD = 0.07$) relative to the past condition ($M = 0.004$, $SD = 0.02$) although this difference did not reach significance ($p = .054$).

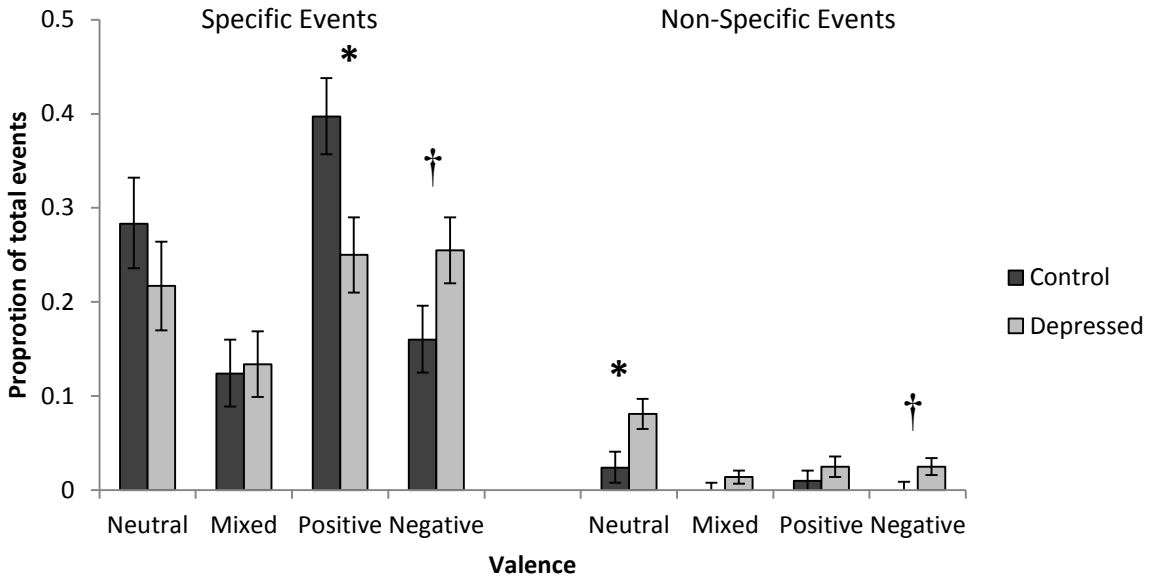

Figure 10: The proportion of events falling into valence categories, as a function of specificity and experimental group, collapsed across conditions. ***$p < .001$; **$p < .01$; *$p < .05$; †$p < .10$.

4.4 Discussion

4.4.1 Content of autobiographical events

Overall, the current study indicated that the majority of events provided by participants were categorized as leisure activities and relationship episodes, while very few events concerned health and illness or 'other' episodes. D'Argembeau and Van der Linden (2004) found similar results, with the majority of events generated involving leisure activities (including social events like parties and weddings), and relationship episodes (including romantic episodes, break-ups and arguments), Similarly, Schlagman and colleagues (2006) found participants generated events typified by people and conversations (i.e., relationships),

and leisure activities and holidays, although they also found that many events involved accidents/injuries/illness and other stressful events.

Evidence suggests that non-depressed adults show a bias towards generating positive events (Beebe-Center, 1932; Berntsen & Jacobsen, 2008; D'Ardembeau & Van der Linden, 2004; Lishman, 1972; Newby-Clark & Ross, 2003; Rapaport, 1943; Ritchie et al., 2006; Sharot, 2011; Sharot, Korn & Dolan, 2011; Walker, Vogl & Thompson, 1997; Weinstein, 1980). For instance, Schlagman and colleagues found that their sample of young and older adults generated a majority of events that were positive in content (e.g., holidays, special occasions). Thus, we had expected to find group differences in event content that might reflect a positivity bias in autobiographical events typically evident in non-depressed adults. However, there were no group differences in the event content generated by participants in the current study. In fact, the distribution of events across the different event-content categories was remarkably similar. This finding may be explained simply by the fact that the current study employed the use of supportive event cues that could have directed the event content generated by participants. It is plausible that eliciting responses using specific cues may constrain the variation of event content as opposed to the spontaneous free recall of autobiographical events (e.g., Schlagman et al., 2006). Additionally, the use of broader event content categories in the current study may also have served to reduce the amount of variation that could exist in event content between the depression and control groups. As will be discussed later, we did find a group difference when analysing the actual valence of autobiographical events. This suggests that these event content categories may not be a particularly good proxy for coding specific emotional valence.

When breaking down the event content results further by the specificity, we did find some differences regarding temporal direction. Overall, for relationship episodes, participants generated more *specific* events in the past condition but more *non-specific* events in the future condition. It is not clear why this temporal pattern emerged for specific and non-specific relationship episodes, but it is consistent with the general finding that past events tend to be more specific and detailed than future events (e.g., D'Argembeau & Van der Linden, 2004). Given the importance of social relationships to psychological health and well-being, and the diverse and complex ways this relationship is mediated (see Thoits, 2011 for a review), it may not be that surprising that remembered relationship episodes are rich in affective, sensory and other contextual detail and generated more readily than imagined relationship episodes. For 'other' episodes, there were also more *non-specific* events in the future relative to the past condition. It is possible that a lack of specificity for these events also reflects a general lack of event detail to enable the response to be classified into one of the event content categories, with 'other' therefore being a catchall category for vague, generic events.

4.4.2 Emotional valence of autobiographical events

Consistent with previous research indicating an optimism bias of future thinking in the general population (Berntsen & Jacobsen, 2008; D'Ardembeau & Van der Linden, 2004; Newby-Clark & Ross, 2003; Sharot, 2011; Sharot, Korn & Dolan, 2011; Weinstein, 1980), our analysis of variance showed that overall participants generated more positive events in the future relative to the past. Previous evidence suggests a relationship between the emotional valence of future thinking and well-being, such that more positive projections of the future are associated with higher levels of subjective well-being (MacLeod & Conway, 2007; Quoidbach, Wood & Hansenne, 2009). In light of this evidence, it is possible that positive projections of the future function to regulate mood, facilitating happy, positive emotions, and

thus increasing well-being. In addition to positive events, participants in the current study also generated more neutral future relative to past events. It is difficult to say with certainty why we find a future>past pattern for neutral events here, but it is possible that it may be a result of fundamental differences between remembering and imagining. For example, relative to imagined events, remembered events tend to contain more sensory and contextual detail (e.g., D'Argembeau and Van der Linden, 2004), and thus generating higher proportions of emotionally-laden remembered events may reflect the fact that these events have actually happened. In contrast, higher proportions of neutral future events may simply reflect a degree of psychological distance with which one imagines episodes that have not occurred in reality.

Interestingly, participants generated more past events that were mixed in emotional valence in comparison to future events. It is possible that this observation may be explained by the fact that future events are imaginary and typically more abstract in nature. Specifically, given that future events are more difficult to construct (Anderson & Dewhurst, 2009) and contain less phenomenological detail (D'Argembeau & Van der Linden, 2004) than past events, they are also probably less complex – and as such feature only one emotional valence (i.e., either positive, negative *or* neutral). In contrast, real experienced events are rich in phenomenological complexity, often involving different, sometimes conflicting emotions. For example, one participant commenting about a past event said:

> *"There's a lot of emotions that were tied up in that memory too because I was quite homesick and I think I really liked… liked that company and enjoyed that sort of thing… I remember missing my family so it was, yeah. So there's quite a lot in that memory"* [depression group participant]

This comment highlights the emotional richness and complexity involved in remembered events, which may be less likely to occur in imagined events.

Another potential explanation is that remembered events, unlike imagined events, can shift in emotional valence over time. This may occur as individuals are able to look back and reflect on their lives; integrating the interpretation of past events in accordance with current goals, and construct new meanings and/or value out of experiences. Specifically, research points towards a self-enhancement motive (Baumeister, 1998), whereby autobiographical memory may function to help individuals construct and maintain a positive sense of self (Albert, 1977; Conway, 2005; Taylor & Brown, 1988; Wilson & Ross, 2003). Thus, it is possible that some experiences, deemed negative at the time, can later be recalled with more mixed or positive affect. For example, one participant recalling a memory said:

> *"Even though we used to be close friends and it just… we talk and it just wasn't the same quality of conversation that it used to be and it made me feel a bit sad, but I wasn't too worried about it because I understood that we all change with time and some of us don't change at all"* [depression group participant]

This comment may reflect how negative past events can be interpreted in complex ways, that may be motivated by enhancing a sense of self or regulating mood. It is likely that in terms of being able to reflect on events and interpret them in complex ways, these particular processes of self-enhancement or mood regulation are more restricted when imagining future events.

Consistent with previous research (Burt, Zembar & Niederehe, 1995; Lloyd and Lishman, 1975; Ridout, Astell, Reid, Glen & O'Carroll, 2003), we also found group differences in the emotional valence of events between the depression group and the control group. Specifically, in the current study, the depression group generated fewer positive events and more negative events relative to the control group. It is difficult to say with certainty as to

the causal direction of this relationship. For example, it is plausible that a depressed mood may result in a negative bias in the processing of autobiographical information (i.e., mood congruence). As argued elsewhere (e.g., Johnson, Joorman & Gotlib, 2007; Lyubomirsky, Caldwell & Nolen-Hoeksema, 1998) it is also plausible that a negative bias in the processing of autobiographical information, both when remembering and imagining, could play a role in the onset and maintenance of depressive disorder. However, as mentioned, it is also possible that depressive episodes may detrimentally affect the ability to process autobiographical information (i.e., scar hypothesis; see Lewinsohn, Steinmetz, Larson & Franklin, 1981). Interestingly, these results also demonstrate that the control group clearly exhibited the optimism bias documented in the literature (Berntsen & Jacobsen, 2008; D'Ardembeau & Van der Linden, 2004; Newby-Clark & Ross, 2003; Sharot, 2011; Sharot, Korn & Dolan, 2011; Weinstein, 1980), with the majority of their events being positive. This contrasts with the depression group who produced equal proportions of positive and negative events.

The finding that depressed individuals generated more negative and fewer positive events than controls was evident irrespective of temporal direction, and thus the three-way condition x valence x group interaction was not significant. Therefore, our pattern of results do not replicate previous research findings that, in depression, it is specifically *future* thinking that is characterised by *reduced positivity* with *no increase in negative* future projections (Bjärehed, Sarkohi & Andersson, 2010; MacLeod, Pankhania, Lee & Mitchell, 1997; MacLeod, Rose & Williams, 1993). The divergence between our results and those studies may be explained by methodological differences. For example, many studies investigating future thinking in depression have employed the use of the *Future Thinking Task* (MacLeod, Rose & Williams, 1993), whereby valence is controlled for *a priori* by the use of cues in two different valence conditions (e.g., positive, negative). However, Young and colleagues (2012)

found that the valence of the cue-word and valence of the generated event did not always match, as depressed participants generated significantly fewer positive events relative to controls in response to positive and neutral cues. To control for this potential incongruence between cue-word and event valence, the current study elicited events in response to neutral event cues, and assessed the valence of events *a posteriori*. Thus, in the current study, when participants had not been primed with a specific valence, the depression group did show an increased generation of negative events, possibly reflecting more habitual patterns of AM retrieval and future simulation. In another study, Andersen and colleagues (1992) found a similar pattern of results to the current study: using a forced-choice paradigm where participants selected the relative likelihood of future events (e.g., *Get into an argument*; *be out on a sunny day*). Similar to the current study, they found that depressed participants predicted more negative *and* fewer positive future events in comparison to non-depressed participants. Therefore, it would seem that paradigms that do not experimentally prime a specific valence may elicit more spontaneous or habitual event responses, and thus may result in a better reflection of the tendency towards generating negative events in depression.

The pattern of increased negative/reduced positive events in the depression group also held when only analysing specific events. Interestingly, however, there were some group differences in the emotional valence of events in terms of non-specific events. The depression group generated significantly more neutral non-specific events in comparison to the control group and there was a trend towards more negative non-specific events. Thus, overgeneral events for depressed individuals in the current study were typified by emotionally neutral and negative events. Although it did not reach significance, the increased generation of negative non-specific events by the depression group could be considered consistent with a proposed mechanism of overgenerality (e.g., CaR-FA-X; Williams et al., 2007) as these events are

possibly a by-product of using functional avoidance to reduce the potential impact of negative memories. However, although the events are impoverished in specificity, the fact that the events are still negative may suggest that an avoidant strategy is not entirely effective in inhibiting *all* negative emotional content. It is important to note that although there were some group differences in the emotional valence of events in terms of non-specific events, these events made up a very small proportion of all the events generated by participants. This is because participants in the current study were instructed to generate *specific* autobiographical events. Thus, the variation in the non-specific events generated in the current study was very small. As an avenue for future research, the adoption of paradigms which elicit both specific and non-specific events equally (i.e., possibly a priori) will likely give a greater range of events in order to compare qualitative features, including event content and emotional valence.

4.4.3 Summary

In summary, Study 2 found no differences in the content of autobiographical events between a healthy control group and depression group composed of individuals who were currently depressed and/or had a history of depressive symptoms. However, in terms of emotional valence, the depression group in the current study exhibited a tendency to both recall *and* imagine more negative but less positive autobiographical events in comparison to the control group. The pattern of results found in the current study was typified by higher proportions of positive events relative to negative events for the control group (i.e. a positivity effect), and equal proportions of positive and negative events for the depression group.

Chapter 5: General Discussion

5.1 Summary of findings

Alterations in autobiographical memory are commonly found in affective disorders (Airaksinen, Larsson & Forsell, 2005; Bearden et al., 2006; Burke & Mathews, 1992; Feinstein, Goldberg, Nowlin & Weinberger, 1998; Huron et al., 1995; Moradi et al., 2008; Muller & Roberts, 2005; Radomsky & Rachman, 1999; Robinaugh & McNally, 2010; Robinson et al., 2006), in particular MDD (Burt, Zembar & Niederehe, 1995; Lloyd and Lishman, 1975; Ridout, Astell, Reid, Glen & O'Carroll, 2003). As posited in the constructive episodic simulation hypothesis (Schacter & Addis, 2007a, 2007b), AM and future simulation are thought to rely on similar processes, both drawing on the same autobiographical knowledge base when remembering the past and imagining the future. As such, alterations of future thinking in MDD have also been found (Bjärehed, Sarkohi & Andersson, 2010; Dickson & Bates, 2006; Lavender & Watkins, 2004; MacLeod & Byrne, 1996; MacLeod & Salaminiou, 2001; Williams et al., 1996). Previous research has focussed primarily on two qualitatively different phenomena of autobiographical processing in MDD; namely, alterations in specificity and emotional valence. The overarching objective of the current studies was to examine these different qualitative aspects of both past and future autobiographical events in depression.

In *Study 1*, we investigated the specificity of both past and future autobiographical events, using two scoring methods to assess event specificity: the scoring protocol from the commonly-used AMT (Williams, Healy and Ellis, 1999), and that of the AI (Levine et al., 2002; Addis, Wong & Schacter, 2008). Consistent with a now vast literature examining autobiographical events in MDD (Barnhofer, Jong-Meyer, Kleinpass & Nikesch, 2002;

Boelen, Huntjens & van den Hout, 2013; Dalgleish, Spinks, Yiend & Kuyken, 2001; Dickson & Bates, 2006; Kuyken & Dangleish, 1995; Moore, Watts & Williams, 1988; Nandrino, Pezard, Posté, Réveillère & Beaune, 2003; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988; Williams et al., 1996) and remitted depression (Mackinger, Loschin & Leibetseder, 2000; Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Scott, Stanton, Garland & Ferrier, 2000; Spinhoven et al., 2006), we found an overall reduction in specificity of autobiographical events generated by a group of participants who were currently depressed and/or had a history of depressive symptoms in comparison to a healthy participant group. Extending these previous findings, we directly compared for the first time the specificity of past and future events and found that overgenerality in MDD was particularly marked for future events. We suggest that this differential deficit is likely due to the additional cognitive demands involved in future simulation, coupled with possible deficits in executive function in MDD. Finally, while we found AMT and AI methods of scoring episodic specificity to be correlated, we also found preliminary evidence to suggest that the AI may be useful for researchers in analysing episodic specificity with greater sensitivity and precision.

In *Study 2*, we performed a content analysis to examine the content and emotional valence of both past and future autobiographical events. We found that the overall content of events generated by the control and depression groups was very similar. However, there were significant group differences in emotional valence. Specifically, we replicated previous findings suggesting a general positivity bias in future thinking in non-depressed individuals (Berntsen & Jacobsen, 2008; D'Ardembeau & Van der Linden, 2004; Newby-Clark & Ross, 2003). Consistent with previous research (Bjärehed, Sarkohi & Andersson, 2010; Burt, Zembar & Niederehe, 1995; Lavender & Watkins, 2004; Lloyd and Lishman, 1975; MacLeod

& Byrne, 1996; MacLeod & Salaminiou, 2001; Ridout, Astell, Reid, Glen & O'Carroll, 2003), we also found a clear negativity bias in the processing of autobiographical information in depression. Specifically, relative to the control group, the depression group produced lower proportions of positive autobiographical events as documented in these other studies, but also higher proportions of negative autobiographical events. Interestingly, this group difference was characterized precisely by control participants generating more positive relative to negative autobiographical events (i.e., positivity effect), whereas depression group participants generated approximately equal proportions of positive and negative events. This difference did not differ significantly for past and future events, suggesting a general negativity bias in depression in the processing of autobiographical information.

Taken together, these two studies suggest that depression is characterized by significant alterations in specificity and valence when remembering the past *and* imagining the future. This observation is consistent with theoretical conceptualizations suggesting a common brain network and cognitive processes underlying the construction of past and future events, as articulated in the constructive episodic simulation hypothesis (Schacter & Addis, 2007a, 2007b). Additionally, the way in which autobiographical knowledge base interacts with the self to interpret and integrate self-relevant information (Conway & Pleydell-Pearce, 2000) is likely to contribute to the onset and maintenance of depressive illness. For example, given that AM is fundamental to the formation and the preservation of identity, presumably the repeated retrieval of negative memories contributes to the construction and maintenance of a negative sense of self (Banks & Salmon, 2013). This in turn is likely to perpetuate negative predictions of the future. These alterations in the valence of autobiographical processes are also likely influenced by specificity, such that overgeneral negative AMs preclude complex and nuanced views of the past and the future, and thus reinforce generic

negative views of the self, of the world and of the future (Beck, 1967). It is likely that these negative *and* overgeneral patterns of autobiographical processing represent a significant obstacle in recovery from depression, and in this way contribute to the maintenance of MDD.

5.2 Underlying mechanisms of overgenerality

Considering that the literature points towards links between overgenerality and delayed recovery in depression (Brittlebank, Scott, Williams & Ferrier, 1993; Dangleish, Spinks, Yiend & Kuyken, 2001), it would appear important to understand what may be underlying an overgeneral pattern of processing autobiographical information in MDD so appropriate treatments can be developed to target the specific mechanisms involved. Prior research has predominantly focussed on the psychological phenomena of avoidance (Hermans, Defranc, Raes, Williams & Eelen, 2005; Kuyken & Brewin, 1995; Lemogne et al., 2009; Raes et al., 2006; Stokes, Dritschel & Bekerian, 2004; Wessel, Merckelbach & Dekkers, 2002) and rumination (Park, Goodyer & Teasdale, 2004; Watkins & Teasdale, 2001, 2004; Watkins, Teasdale & Williams, 2000) as underlying mechanisms of overgenerality. Our sample of participants with current/historical depression did exhibit significantly elevated levels of rumination and avoidance in comparison to controls. Although investigating these particular mechanisms was beyond the aims of the current thesis, we ran follow-up correlations and surprisingly found no relationship between the specificity of past and future events (as measured by the AI) and rumination and avoidance measures (r values < 0.27, p values > .15).

In a follow-up investigation of the current study, Addis and colleagues (2016) administered neuropsychological tests using the same 33 participants employed in the current thesis, plus an additional 15 participants (eight controls and seven depressed participants; 48

participants in total). The authors investigated whether the specificity of autobiographical events (i.e., past and future) was related to subcomponents of executive functions, including fluency, working memory, inhibition, planning, set-shifting and strategy use. Consistent with the findings of *Study 1*, the overgenerality of autobiographical events in the depression group was still evident at the larger sample size, and this pattern was again more pronounced for future thinking in comparison to AM recall. Additionally, a particular subcomponent of executive functioning – strategic retrieval ability – was correlated with the specificity of both past and future events. Interestingly, strategic retrieval surfaced as the only significant predictor of *future* event specificity, over and above avoidance and rumination. Although the sample reported on in this thesis is a subset of that used by Addis and colleagues (2016), the pattern of results were still evident (and significant) for the current smaller sample[3], indicating that strategic retrieval is an important mechanism underlying the overgeneral future thinking exhibited by the depression group in this thesis.

Strategic retrieval, as captured by the semantic clustering score of the CVLT-II, reflects the ability to initiate a semantic strategy in the generative search of episodic memory (Conway & Pleydell-Pearce, 2000). Given that overgenerality is thought to result from a disrupted generative search process (Williams et al., 2007), and simulating the future will always involve a generative search (unlike past events which can be directly accessed), it is probably not surprising that strategic ability only predicted the specificity of *future* events. Moreover, future simulation has more executive demands considering that it requires the

[3] A hierarchical linear regression on the proportion of specific future events was run using data from the participants in the current study. The first model included BDI-II, RRS rumination and CBAS total avoidance scores as predictors but was not significant ($p = .666$). However, the inclusion of a measure of strategic retrieval ability (CVLT-II semantic clustering score) resulted in a significant model, $F = 4.75$, $p = .036$, where strategic retrieval was the only significant predictor ($\beta = .745$, $p = .008$; for all other predictors, $p > .148$).

generation of a novel scenario and the strategic recombination of autobiographical details (D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010). It is possible that depressed individuals rely on other, less optimal, strategies – determining what these are and how to refocus individuals onto more effective strategies is an important direction for future research.

5.3 The role of future thinking in psychological wellbeing

Our capacity to create past and future worlds through memory represents a unique and fascinating human faculty. It allows us to transcend temporal and spatial boundaries – not physically, but through our mental constructions. This ability of *mental time travel* into the past and the future (Suddendorf & Corballis, 1997; Tulving, 1985) is highly advantageous as it enables and facilitates learning, flexibility when faced with new experiences, and helps shape more desired present and future outcomes (Suddenorf & Corballis, 2007). In particular, *future*-oriented mental time travel allows us to safely navigate our lives through planning, goal setting, daydreaming, and forming aspirations, predictions, and expectations. As mentioned, there is now a wealth of evidence that the general population exhibit a tendency to engage in positive future thinking (i.e., optimism bias; Berntsen & Jacobsen, 2008; D'Ardembeau & Van der Linden, 2004; Newby-Clark & Ross, 2003; Sharot, 2011; Sharot, Korn & Dolan, 2011; Weinstein, 1980). It has been argued that an optimism bias and other aspects of positive future-oriented thinking may be important as a way of coping with challenging and stressful life events (Aspinwall & Taylor, 1997; Taylor, 1983; Taylor & Schneider, 1989). A bias of future thinking can help maintain, and in fact enhance, a positive sense of self (Robinson & Ryff, 1999). Indeed, there is some suggestion that a positive bias in future thinking is linked to psychological well-being (MacLeod & Conway, 2007; Quoidbach, Wood & Hansenne, 2009). On the balance of this evidence, positive future thinking in healthy adults appears to play an important role in terms of mood regulation and self-enhancement,

and may allow individuals to problem solve, gain a sense of mastery and personal control, and construct meaning out of life experiences (Taylor, Kemeny, Reed, Bower & Gruenewald, 2000).

The studies in the current thesis reveal the potential difficulties that may occur for future thinking in individuals experiencing current symptoms of depression, or who have in the past. In *Study 1*, we not only replicated previous findings indicating that future thinking in depression is typified by a reduction in specificity (Dickson & Bates, 2006; Williams et al., 1996), but found overgenerality in future thinking to be particularly marked. It is plausible that overgeneral processing would stifle the benefits that future thinking could offer depressed individuals in terms providing mood regulation. For example, the motivation and sense of hope that may be provided by the planning and attainment of specific goals may be inhibited by a tendency to imagine these goals in an abstract and overgeneralized manner. Indeed, depression is found to be associated with difficulties generating specific goals or specific reasons for the attainment of goals (Belcher & Kangas, 2014; Dickson & Moberly, 2009).

The advantages of future thinking are likely to be further hindered in depression by the tendency to imagine the future as involving negative, unfavourable events. Accordingly, in *Study 2*, extending on previous findings indicating alterations in the emotional valence of simulated future events in depression (Bjärehed, Sarkohi & Andersson, 2010; Lavender & Watkins, 2004; MacLeod & Byrne, 1996; MacLeod & Salaminiou, 2001), we found that the depression group generated less positive *and* more negative future events than the control group. Given this negativity bias in depression, it would appear that future simulation may not offer the psychological utility it can offer non-depressed individuals in terms of regulating

mood through self-enhancement. Consequently, future thinking in depression may operate along the lines of maintaining self-coherency; however the perception of self that is perpetuated is negative. This may suggest why overgeneral future thinking would have some adaptive value in reducing negative affect about the self (Raes, Hermans, de Decker, Eelen, & Williams, 2003) in the short-term, however in the long-term impedes opportunities for alternative and more positive perceptions of the self and of the future.

5.4 Therapeutic implications

There have been recent attempts to develop memory therapeutics, which target specific alterations in autobiographical processing associated with MDD. One of these interventions targeting overgeneral thinking is memory specificity training (MEST), which aims to help enhance the specificity of AMs. MEST involves a number of weekly sessions, whereby individuals are oriented to the main concepts underlying overegeneral thinking and then trained to generate specific events with special attention paid to spatio-temporal, sensory-perceptual, and other contextual features of experiences. Between sessions, individuals are instructed to write down a specific event occurring during each day. The emotional valence of events are also addressed, as participants are trained to recall specific events in response to negative cue words (e.g., clumsy, stressed, sad). There have been some promising initial findings regarding the effectiveness of MEST. Raes and colleagues (2009) initial uncontrolled trial found a significant increase in the specificity of retrieved AMs in a depressed sample following MEST, as well as significant decreases in rumination and experiential avoidance. In the first randomized controlled trial (RCT) of MEST, Neshat-Doost and colleagues (2012) found that depressed individuals exhibited enhanced specificity of AMs following MEST, and these improvements in specificity mediated subsequent improvements in depressive symptoms.

Taking into account the role of future thinking in terms of coping (Aspinwall & Taylor, 1997; Taylor, 1983; Taylor & Schneider, 1989) and wellbeing (MacLeod & Conway, 2007; Quoidbach, Wood & Hansenne, 2009), understanding specific future thinking processes may bolster both theoretical and therapeutic concepts. For example, Pham and Taylor (1999) were interested in investigating the effect of different types of future simulation with regards to goal-directed behaviour. Specifically, in a student sample, the authors compared two forms of future-oriented thinking: *outcome simulation* (imagining the particular outcome that one would like to achieve) and *process simulation* (imagining the processes or steps needed to achieve a particular goal). The authors found that students employing process simulation performed better on a midterm exam in comparison to students employing outcome simulation, which was found to be related to significant reductions in anxiety associated with the exam. The findings of this study suggest that future thinking in relation to goal-directed behaviour may be more beneficial when focussed in a detailed and step-wise manner (i.e., process simulation) because it provides problem-solving and planning strategies, which are not only likely to result in the increased likelihood of achieving goals but also in turn help regulate negative mood states and provide motivation. Thus, developing a therapy based on process simulations that aim to improve future simulation, and ultimately mood and motivation, in depression could be a fruitful direction for future research.

5.5 Limitations

There were a number of limitations to the studies reported in this thesis that should be recognized. One limitation was in relation to the experimental design, given these data were collected in the context of a larger study investigating the neural correlates of generating past and future events in depression. Specifically, the autobiographical events generated by participants in the current studies were initially generated within the MRI scanner, and then

retrospectively elaborated on in the post-scan interview in order to assess specificity. It is possible that this second step of elaboration may have resulted in irregularities in the specificity of past and future events, which may not have been found in a more direct behavioural experiment.

Another limitation in the experimental design was related to the event cues adopted. Given that concrete cues have been shown to be more effective in eliciting AMs relative to abstract cues (Rubin & Schulkind, 1997), we employed the use of more supportive cues in order to facilitate greater specificity of events. This was a departure from the standard administration of the AMT, which uses abstract emotion-laden cues. The use of supportive cues may have contributed to the absence of a group difference in specificity for past events reported in the current study. However, the differential reduction for future events was still evident, indicating that the supportive cues were not sufficient to ameliorate that deficit.

Also, alterations in the processing of past and future autobiographical events are commonly found in both individuals currently experiencing depressive symptoms (Barnhofer, Jong-Meyer, Kleinpass & Nikesch, 2002; Boelen, Huntjens & van den Hout, 2013; Kuyken & Dangleish, 1995; Moore, Watts & Williams, 1988; Nandrino, Pezard, Posté, Réveillère & Beaune, 2003; Williams & Broadbent, 1986; Williams & Dritschel, 1988; Williams & Scott, 1988) and those with a history of depression (Mackinger, Loschin & Leibetseder, 2000; Mackinger, Pachinger, Leibetseder & Fartacek, 2000; Scott, Stanton, Garland & Ferrier, 2000; Spinhoven et al., 2006). Although a follow-up analysis did not reveal any differences between the results for those who were currently vs. previously depressed (see Section 3.4.1), the heterogeneity of participants recruited into the depression group in the current thesis represents a limitation worthy of noting. Additionally, the relatively small sample size

potentially resulted in subgroup comparisons (e.g., currently depressed versus a history of depression) lacking in power.

Finally, it is of some worth acknowledging the predominance of female participants comprising the current sample. Epidemiological studies do suggest significantly higher rates of depression are reported in females in comparison to males, with an average ratio of 2:1 for current and lifetime episodes (Kuehner, 2003). However, it is possible that the inclusion of more male participants in the current study may have produced different findings. For example, research suggests that females generate autobiographical memories faster (Davis, 1999) and with greater episodic specificity (Pillemer, Wink, DiDonato, & Sanborn, 2003) in comparison to males. It is possible that including more male participants in the current study may have resulted lower rates of specific events overall, and potentially a more pronounced group difference in the specificity of autobiographical events.

5.6 Conclusions

Although previous research has focussed primarily on alterations of past events in MDD, the findings in the current thesis suggest that the specificity of future events is most affected in depression. Additionally, alterations in the valence of past events in depression (e.g., decreased access to positive *and* increased access to negative events) are also evident for future, as well as past, events. Given the role of future thinking in effective problem solving, adaptive coping and well-being, it is crucial that we continue to investigate the processes underlying future simulation and the function it may play in depressive illness. Understanding these processes may allow for new therapeutic developments to emerge, with a particular focus on enhancing future thinking.

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Appendices

Appendix A: General Instructions for the fMRI Session

Pre-Scan Instructions

I want to begin by telling you a bit about this study – we are looking at autobiographical memories, so memories for your own past events and experiences, and events which might happen in the future. I want to reassure you that anything you tell me here will be kept confidential.

[Show the past & future trial example sheets, covering the rating scales] Over the course of the experiment, I will be showing you a number of cue words. For each one, I will be asking you to either **remember** an event from your own **past** that this cue reminds you of, or to **imagine** an event which may occur in the **future**. Importantly, I want you to think of events that happened **within the last few years** or are likely to happen **within the next few years**.

Please try to think about events which are from a **specific time and place**. For example, thinking about a 3 week holiday would not be sufficient. However, a specific incident that happened on one day during your holiday would be good. I want you to remember or imagine as much **detail** as you can about the event. Try and remember or imagine these event through **your own eyes**, as you would experience it if you were there, rather than from an external vantage point where you see yourself in the event.

One concern many participants have is that the event they think of is not an important one in the grand scheme of things. It doesn't matter whether the event is important or whether it is just something trivial, just as long as it is an event which is specific in time and place. It is more important that you come up with events that you **remember personally experiencing** (rather than retelling an event you were told about). For the future events it is important that this event **could reasonably happen** in your future given you plans and thoughts about the future. Also, the future events you imagine should be novel. In other words, don't just recast something that has already happened to you as being in the future, try and think of a new event.

The event does not have to specifically involve the cue word provided, but you should try and keep to something close to this word because after the experiment, I will be asking you to tell me about the event you came up with for every cue word during the testing session. If you get too far away from the cue word, you might start to get the events mixed up. An example might be that the cue word "sunset", makes you think of a BBQ that you had late one afternoon and the sun was going down but the event isn't really related to the word "sunset". The same thing counts for holidays, which you may or may not celebrate. For example, if

there was the cue “Easter” but this is not a holiday you normally celebrate, then try and think of something similar or something related to that. Alright?

[Explain rest of trial sequence using example sheets, i.e., when to press button, the rating scales]

You will have 20 seconds to come up with an event. Once you have the event, you will make a **button-press** to indicate you have the event (e.g., this would be at the point where, if you were telling me about it, you would probably start talking). [**Point out button and demonstrate**.] Note that when you press the button, the screen will NOT advance; you just have to continue thinking about the event until the screen changes. Even though the screen doesn’t change, the program will log when you pressed the button, which is really important for us because I can only use your data if I have these responses in there.

So, once you have pressed the button and for the remainder of the 20 seconds, you will **elaborate** on the event, and try to remember or imagine as much detail as you can about the event. The amount of time you have to elaborate will change depending on how long it takes you to come up with an event (e.g., if it takes you 10 seconds and you pushed the button at that time, you will have 10 seconds to elaborate; if it takes you 16 seconds, you will only have 4 seconds, but that’s okay).

Next you will be asked to **rate how much detail** you were able to come up with for the event. A rating of one stands for very vague events and a four for very vivid events. Also, you will be prompted to **rate how emotional** this event made you feel when you thought about it. You will have 5 seconds for every rating so please go on your gut feeling.

[Explain control task using trial sequence example sheet]

During the experiment there will also be **one other task**. For this task a cue will be shown and you are asked to firstly, think of two objects related to the cue, then to order the two objects you thought of and the cue you were shown on the screen by physical size from largest to smallest. For some of the cues, it might be that the object word refers to more than one kind of object (e.g., bulb could be a light bulb or a tulip bulb) but just go with whatever comes to mind first. Also, some of the objects you think of might be fairly close in size, but make your best guess when ordering them from smallest to largest. Once you have thought of the two objects and ordered them by physical size, again, I want you to **press the button**. Note that again, the screen will NOT advance, but for the remainder of the 20 seconds you have to define the two objects. Here I am looking for something like a dictionary definition. So you can think about the shape of the object, and the use of it. Think of a generic rather than a specific definition. Alright?

Unlike the imagined or remembered events, I will not ask you again about the objects you come up with during the task. So you don't need to worry about keeping them in your mind until later. Okay?

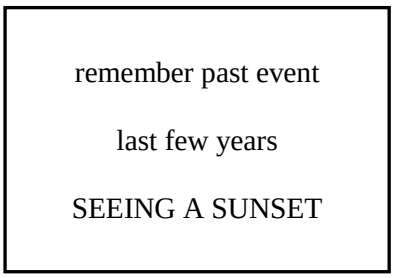
So, once you have come up with two related objects, ordered them and the cue object by size, pushed the button and come up with a definition for the objects, I will ask you again to **rate how detailed** on average your word definitions were and also **how difficult** you thought this task was. Again, you will have 5 seconds to make each of these ratings.

And please complete all the tasks **silently**, in your head. This is because during the scan, you must keep as still as possible - and talking will cause your head to move. Even moving a few millimetres will make the scans blurry and probably unusable. However, in the scanner, there will be padding placed around your head to help you keep as still as possible.

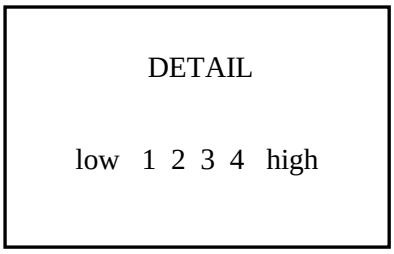
[Run practice trials and get participant to report back what they were imagining/remembering and what they did during the trial sequence. Give more practice trials if necessary. (Past: GOING TO A PLAY; Future: GETTING TAKEAWAYS; Object: ICEBERG)]

While you are lying in the scanner we will take three different pictures of your brain. First we will take a picture of your brain anatomy. This scan will take around 5 minutes and if you would like we can play some music for you during that time. The second part of the scan will take around 40 minutes during which time you will be doing the task we just practised. There will be five small breaks in between parts of the task. For the last scan which will take about 7 minutes, you will need to look at a cross on the screen and try to stay awake. Please lie still at all times. It is important that you keep still with your whole body including your feet because any movement will make the scan fuzzy.

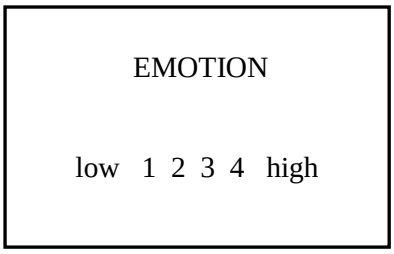
RECALLING PAST EVENTS



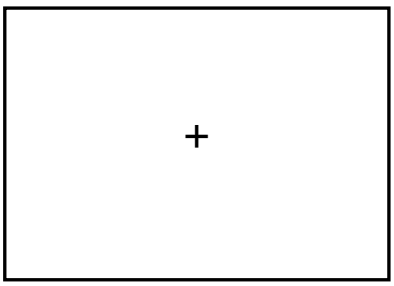
- A **CUE** is given.
- **RECALL** an event that this cue reminds you of (doesn't have to involve the cue specifically) and which has happened in the past few years.
- When you have thought of a specific event, **PRESS THE BUTTON** and then continue to recall as much detail as you can about the event until the next screen appears.



- **RATE** the amount of **DETAIL** you were able to recall.
- 1 = vague with no/few details
- 4 = vivid and highly detailed



- **RATE** the amount of **EMOTION** that this event made you feel.
- 1 = detachment, no emotional experience
- 4 = intense emotional experience

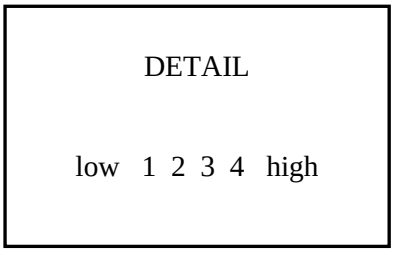


Example:

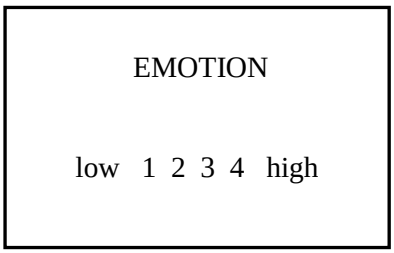
The year before last I went on a holiday to Cyprus. For the last evening of the holiday, I prepared a meal from the local shop with yummy tomatoes and fresh lettuce, some tuna and a few bread rolls. I sat on the balcony with my mum listening to the waves coming in and watching the sun set. We had a beautifully fragrant bottle of local white wine with the meal and just sat there enjoying each other's company and the view of the sun and the sea.

ENVISAGING FUTURE EVENTS

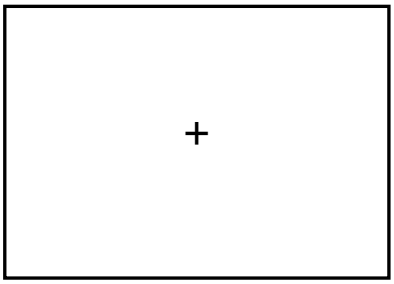
- A **CUE** is given.
- **IMAGINE** an event that this cue reminds you of (doesn't have to involve the cue specifically) and which is likely to occur in the next few years.
- When you have thought of a specific event, **PRESS THE BUTTON** and then continue to come up with as much detail as you can about the event until the next screen appears.



- **RATE** the amount of **DETAIL** you were able to imagine.
- 1 = vague with no/few details
- 4 = vivid and highly detailed



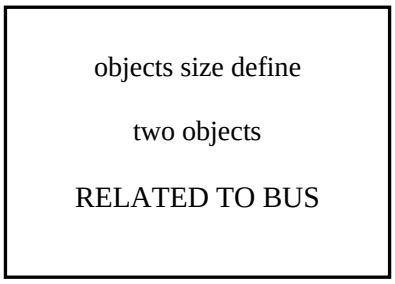
- **RATE** the amount of **EMOTION** that this event made you feel.
- 1 = detachment, no emotional experience
- 4 = intense emotional experience



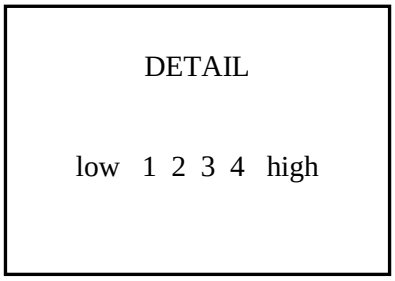
Example:

Next year, I am planning to enrol in a surf course. I will be going to Mount Maunganui, to the beach house of my parents in law and go down to the main beach. There I will be enquiring about the beginner courses that are offered and take a trial lesson. I will be pretty scared to start with and pretty clumsy, too. Falling off the board and getting sore arms from paddling, but really proud at the same time, because this is something I have wanted to do for a long time.

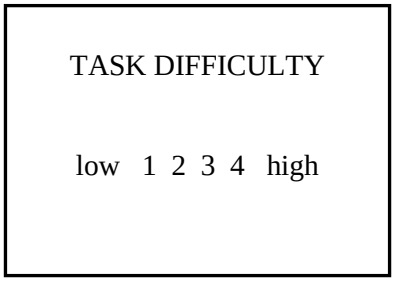
WORD/OBJECT TASK



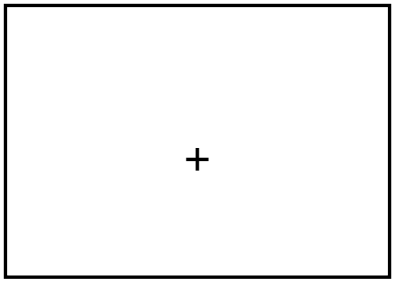
- A **CUE** is given.
- Think of **2 OBJECTS RELATED** to the cue object.
- Order the two objects and the cue by **PHYSICAL SIZE** from largest to smallest.
- **PRESS THE BUTTON** when you have done this.
- Then go through and **DEFINE** each of the 2 objects in order - try to come up with as much detail as you can about the meaning of each word until the next screen appears.



- **RATE** how much **DETAIL** on average your word definitions had.
- 1 = vague with no/few details
- 4 = highly detailed



- **RATE** how **DIFFICULT** the task was to complete.
- 1 = low difficulty/easy
- 4 = high difficulty/hard



Example:

Related words: *"bridge" and "bus driver";*
Order by size: *bridge, bus, bus driver*
Definitions: Bridge*: metal or wooden construction to enable travelling across rivers, the sea or a valley in a vehicle or on foot;* Bus: *a motorised vehicle with a large number of seats and a large boot underneath, has at least four wheels* Bus driver: *the person steering the bus, usually wears uniform, has a special license to be able to transport many people*

Appendix B: List of Cues Provided to Participants to Facilitate the Generation of Autobiographical Events

All Event Cues

- The boss
- At a hospital
- Christmas day
- On the motorway
- Family celebration
- New friend
- An argument
- On a farm
- A day trip
- At a bach
- At a casino
- Doctor's visit
- A big purchase
- A special gift
- An accident
- At a wedding
- Losing something
- New year's eve
- A first kiss
- A winter's day
- At the beach
- An interview
- At the dentist
- Attending prizegiving
- Taking a taxi
- A new baby
- An election
- A holiday
- A bad stain
- A phonecall
- Mother's day
- Visiting someone
- Helping someone
- Out with friends
- A bush walk
- First day at work
- Going on a date
- Having a picnic/bbq
- A party
- Having a haircut
- Something stolen
- At a restaurant
- At the airport
- Getting/losing a pet
- Sitting a test
- A sports game
- Moving house
- A live performance

Cues for Pre-selected Events Transcribed for AI scoring

- The boss
- Christmas day
- On the motorway
- Family celebration
- New year's eve
- A first kiss
- A winter's day
- Attending prizegiving
- A bad stain
- A phonecall
- Mother's day
- Visiting someone

Appendix C: Adapted Autobiographical Interview Scoring Manual

Adapted Autobiographical Interview Scoring Manual

(Version: January 2008)

From: Addis, DR, Wong, AT, Schacter, DL (2008). Age-related changes in the episodic simulation of future events. *Psychological Science, 19*, 33–41.

Adapted from: Levine, B, Svoboda, E, Hay, J, Winocur, G, Moscovitch, M. (2002). Aging and autobiographical memory: dissociating episodic from semantic retrieval. *Psychology and Aging, 17*, 677-689.

Overview

The Adapted Autobiographical Interview quantifies elements of descriptions of specific events from the subject's personal past (i.e., recollections) and events which may occur in the subject's personal future (i.e., simulations). In each trial, a cue word (e.g., "DOG") and a time period (e.g., "Next Few Weeks"; "Past Few Years") is shown. The subject must think of a specific event in the time period that the cue makes them think of, and describe as much detail as possible within 3 minutes. The events must be specific to a particular time and place. When describing events, general probes may be used by the interviewer to focus the subject on a specific event and to encourage full description (e.g., "Can you tell me more about that? Can you describe a specific incident relating to that event?")

The interview is recorded digitally and transcribed. For each event, the scorer isolates or defines the main event, then divides the entire response (including information external to the main event) into small segments (details). These details are categorized as either "internal" or "external" to the main event. This will be explained in more detail below.

Isolating and defining the event

Although the test instructions request specific events, many subjects give more than one event or events that are difficult to define (i.e., non-specific events). It is therefore necessary to be clear what the event is before any scoring takes place. This will come into play when categorizing segments, as segments that are not part of the event (external details) are tallied separately from those that are part of the event (internal details).

Subjects are instructed to provide an event in which they were personally involved and that is singular (not repeated) and specific to a time and place. The event should be restricted in time, no more than a few hours in duration. If an event extends over days or weeks (e.g., a vacation), the scorer must restrict scoring to the best time-restricted event available. If more than one exists, choose the time-restricted event which is described in most detail. In such cases, the examiner will have tried to focus the subject on a single event in the probing conditions.

One of the most difficult scoring situation is when the event is very impoverished or non-existent (e.g., only factual information is given, or an event that was repeated). In such cases, it may be possible to select some details as *probably* specific to an event and to score them accordingly, but qualitative ratings cannot be assigned.

Text segmentation and categorization

A segment, or detail, is an information bit; it is a unique occurrence, observation, fact, statement, or thought. This will usually be a grammatical clause -- a sentence or part of a sentence that independently conveys information (i.e., a subject and a predicate), although a single clause may contain more than one detail. For each clause, consider whether its constituent parts convey additional information. If so, the parts can be separated and scored as separate segments. For example, the statement "he had an old, brown fedora" would be segmented into three details: a "fedora" is different from a "brown fedora", which in turn is different from an "old brown fedora". Each of these details adds information that significantly alters the meaning of "fedora", which on its own would receive one detail.

The main categorical distinction for details is internal or external to the event. To be categorized as **Internal**, a detail must pertain directly to the main event, isolated as defined above. Internal details can include the following:

1) **Event details.** Overall, event details describe the unfolding of the story. They are usually happenings (e.g., "I fell down"), but also include who was there (1 point per name/person up to a maximum of 5), reactions/emotions in others, the weather, one's clothing, physical occurrences and actions of others. If an item qualifies to be in another category (e.g., perceptual richness), then priority is given to that more specific category. An item cannot be scored as an event detail if it is in another category.
   e.g., He jumped out of the chair; It was sunny; My sister Sue was with me; She was jealous/angry/happy; We went to the hotel; It was my birthday.
2) **Place details.** Any information that involves localization in space, including countries, bodies of water, provinces, cities, streets, buildings, rooms, and locations within a room. Note that one's own orientation in space ("I was to the right of Edgar") is considered a perceptual detail.
3) **Time details**. Life epoch ("My twenties"), year, season, month, date, day of week, time of day, or clock time. Note that duration information ("We were there for 20 minutes") is scored a perceptual detail. Information about sequences of events ("Mary came later than Sam") are scored as event, not time details.

   It has been argued that one cannot directly encode or retrieve temporal information (i.e., when an event occurred), but only infer it from other information. That is, it is not possible to re-experience a given point in time without reference to some related episodic thought, feeling, or other detail. Therefore, when scoring time information, people should not be penalized for making inferences (which are usually scored as "other" details), because this is the normal way to figure out when something occurred.

4) **Perceptual details**. Perceptual details include auditory, olfactory, tactile/pain, taste, visual (object details, colours), spatial-temporal (allocentric-egocentric space, body position and duration). In the case of objects, it can be difficult to distinguish between a perceptual and an event detail. Objects that are directly involved in the unfolding of an event are considered event details ("We lit the candles") whereas objects that are part of the perceptual landscape are considered perceptual details ("There were lit candles everywhere").
5) **Emotion/Thought details**. Any detail that pertains to the mental state of the subject at the time of the event. These include feeling states, thoughts, opinions, expectations, or beliefs. Thoughts expressed in retrospect (either at the time of the interview or at any time after the event occurred - "I found out later I was wrong") are tallied as external. Beliefs or opinions that are long-standing (not specific to the event - "I never believed in ghosts") are also external and are scored as semantic details. Inferences about other people's mental state ("She was sad") are considered event details, unless these inferences reflect the subjects' own mental state at the time ("I thought he was angry with me"), in which case they are internal thought details.

External details events that are not part of the main event or factual (semantic) information that is not specific to the main event. These can include the following:

1) **Semantic details**. Semantic details involve general knowledge or facts. They can represent general knowledge ("Paris is the capital of France") or be specific to the person ("I always hated yams." "I worked as an engineer"). The distinction between semantic and other kinds of details can depend on the context. For example, "Paris fell to the Germans" would be semantic if it is described as a historical fact ("We couldn't go to Paris because it was in German hands") or an event detail ("We watched in disbelief as Paris fell to the Germans.") In general, details that reflect a long-standing state of being or without a clear beginning or end are considered semantic. Semantic information can be "brought in" to episodic recollection (and scored as an internal detail) if it becomes an integral aspect of the episode: "Arizona is hot" is semantic, but "Arizona was hot when we went there" is episodic. Note that the richness of the description is independent from the episodic/semantic distinction; very richly described factual information is still semantic, and impoverished, minimal details can still be episodic.
2) **Repetitions**. A detail is a repetition if it is an unsolicited repetition of a prior information-containing detail. It does not have to be a verbatim repetition, but it should not add any new information to the prior detail ("I hoped for the best. I kept my fingers crossed" -- second sentence is a repetition). Score all repetitions, even if they are part of normal discourse, except for repetitions that are clearly prompted by the examiner, which may occur if the examiner queries a detail that was given earlier**.** Repetitions must convey information (as opposed to just words that are repeated). In the example below, "… and stuff" is repeated, but there is no information in this utterance, so it is not considered a repetition. As well, only score repetitions when they convey the same information as in an earlier detail. In the example below, "They really really liked me" is not a repetition of "They were happy with my work." Similarly, "I was a carpenter's

helper", "I helped them", and "They could depend on me" are all different. "They liked what I did" however is the same as "They liked my work." Then he repeats this repetition straight away.

3) **Other details**. This category is for details that do not reflect recollection and do not fit into other categories. It includes meta-cognitive statements ("Let me see if I can remember that"), editorializing ("That doesn't matter." "That's amazing."), inferences ("I must have been wearing a coat because it was winter"), or other statements that convey verbosity but are not related to the main event. Replies to a query that are clauses (E: "Do you remember any more about that day? S: No, right now I don't. I don't remember anymore") are also scored as "other", although simple reflexive replies such as "No" are not scored. Do not score an "other" detail for any utterance - only those that contain information. Generally an "other" detail will be a clause of some sort. Fragments such as "um" are not scored.
4) **External episodic details**. Episodic events that are secondary to the main episodic event, e.g. if the person is imagining the birth of their first child (as the main event), but <u>also</u> talks about going to the pharmacy to buy prenatal vitamins a few months before.
5) **External generic events/routines**. Semantic details that refer to events (and not general knowledge), but events that are repeated or routine, e.g. "I always go to the dairy down the road."

The **sums of internal and external details** are important measures of a subject's performance. With experience, a scorer will be able to simultaneously segment and categorize a response.

In some cases it can be difficult to distinguish internal from external details. The rule of thumb in these cases (the "benefit of the doubt" rule) is that if a detail <u>could reasonably be internal</u>, it is scored as such. This rule, however, should not be applied to all details that could <u>possibly</u> be internal; only those that could reasonably be internal.

Scoring example

```
          EXT1                  EXT2              EXT3        EXT4
It was a company / out of New Bedford / that was building / & did the shelves and

            EXT5     EXT6                                 EXT7              EXT8
that,/ the rough /carpenter work /& then there was another company/ that came in/

           EXT9             EXT10                  EXT11
and did the finish work /but they were all happy /with my work and stuff /and

         EXT12                    EXT13                              EXT14
saw that I listened and stuff /and I was a carpenter's helper / and I helped /

        EXT15                          EXT16
when they needed something /and they could depend on me /and the company really

EXT17             EXT18             REP(of EXT18)
really liked me / what I did /and the work I did and stuff./
```

Categorization: All details are classed as external as there is no specific, time-limited event described. The subject is describing the company he worked for and his role. However, this is somewhat open to interpretation. Another scorer might decide that the description of another company coming in (i.e., *"another company came in and did the finish work but they were all happy with my work and saw I listened"*) is a single episode rather than a matter of due course on every job. This is an example of a judgement call. Many scoring decisions are judgement calls. Scorers will be somewhat influenced by their own knowledge and experience with the subject matter. Score according to your knowledge. If two people could reasonably score a detail more than one way, simply score it the way that seems best rather than agonize over it.

Segmentation: The clause *"It was a company out of New Bedford that was building"* contains three details, *a company,* from *New Bedford,* that does *building.* Thus, *"company"* can stand alone (i.e., he works for a *company*, and not, for instance, himself) but the subject tells us something about what type of company it is (i.e., they do *building*). The second detail is a place detail, telling us that the company was based in *New Bedford*. This clause illustrates that one cannot always find the dividing line between details. The dividing of segments can be somewhat arbitrary. Where one places the dividing lines is not as important as the number of information bits one scores.

The "shelves … and rough carpenter work" can be segmented into three details: "*doing shelves"* (a type of building), "*carpenter work"* (another description of the type of work), and then further refining the carpenter work (as *"rough"*). Next, another company comes in. This instance of *"company"* is not a repetition of the first, as it is a *different* company. The *"coming in"* was scored as a separate detail because it implies a happening, something this other company did. Their being happy is a state of being/emotion; the cause of the happiness (i.e., the subject's work) is a further detail. Likewise, the subject imparts a number of details about his role: a "*carpenter's helper"*; the task was to *help*; but not just whenever, but *"when something was needed"*; he was dependable (*"they could depend on me"*); the *company liked him*; and they also liked the work he did (*"what I did"* and repeated in *"the work I did"*)

We have come up with some other **segmentation rules**, given scoring dilemmas which have arisen:

- **Time details**: The location of the event in time (e.g., *"next few weeks", "in a couple years", "yesterday"*) should not be segmented as this usually reflects the time period given as part of the cue; SCORE=1
- **Relationship details**: The relationship of the subject to someone else (e.g., *"boyfriend", "last boyfriend", "uncle", "great uncle", "friend", "best friend", "Donna's friend"*) should be SCORE=1 if this is used as a pronoun. Often, as the subject doesn't know the examiner, they will just consistently refer to someone as "*my best friend*". However, if they have used the name and are using the phrase to describe the relationship, then it can be segmented accordingly (e.g., "*she was my best friend*" is SCORE=2 as she's not just a friend, but a *best* friend.)

- **Activities**: *"I was sitting on the couch"; "I was driving to the market"* are SCORE=2 phrases, as *"I was sitting"* and *"I was driving"* are activities in of themselves. The subject doesn't need to provide the location of sitting (*"couch"*) or the destination of driving (*"market"*) for it to make sense. However, *"I went to the market"* is a SCORE=1 phrase, as *"went"* is not a stand-alone activity.
- **Senses**: *"I saw the tower", "I heard a noise"* are all SCORE=1 phrases as the sense description is part of the experience of the content (i.e., you can't see a noise or hear a tower). Also, the sense verbs cannot stand alone (e.g., *"I saw."*)
- **Dialogue**: Whether the dialogue is external (speech) or internal (thoughts), each statement/thought represents one detail (i.e., it is one happening) and so it is not segmented (e.g., "I thought, blah blah blah" or "She said, 'blah blah blah'" are both SCORE=1 phrases). If there are masses of dialogue, then divide it up reasonably, by phrases.
- **Emotions**: If a feeling is followed by the cause or target of the feeling (e.g., "I was happy that he came over"), then it is a SCORE=2 phrase. This is because "I was happy" can stand alone, and more information is provided by describing the reason.
- **Metacognitive**: "I remember", "let me see if I remember", "I can envisage" SCORE=1 (External)
- **Quantities**: "There were skins" SCORE = 1; "there were all these skins" SCORE = 2; "there were 500 skins" SCORE = 2

Other segmenting and scoring tips

- "Negative" events, or the absence or failure of something to occur ("Bob wasn't there") are still scoreable, as they reflect the subject's recollection.
- External details include both external episodes and semantic details. In cases where the two are difficult to distinguish, apply the benefit of the doubt rule.
- Do not give credit for information that is not there. "We went to a place where we could swim with the dolphins" contains one descriptive event detail, but the actual location is not mentioned, so it is not scored under place details. The place is implied, but is not scored until it is mentioned.
- Scoring of fragmented sentences should allow for natural speech patterns even when they do not appear fluent in the transcription. The scorer should attempt to interpret fragmented sentences in a way that would be transparent to others.
- Repetitions should be segmented as finely as internal and other external details

Remember: Segmentation of details should be consistent regardless of whether the details are internal or external.

Appendix D: Qualitative Coding Guideline

Each event is to be assigned ONE event content code and ONE emotional valence code.

Event Content
Categorise each event according to ONE of the following "types" of events:

(1) Leisure activity;
(2) Relationship episode;
(3) Work/Academic episode;
(4) Health/Illness episode (including accidents, deaths, etc.);
(5) Other.

If an event crosses multiple categories, use your best judgment of the MAIN focus of the event as to which category it falls into. For example, if an event may involve a leisure activity but the event description is more focused on the relationship with another person within the event, the event should be classified as a "Relationship episode".

Event Valence
Categorise each event according to ONE of the following valence categories:

(0) Neutral;
(1) Mixed;
(2) Positive;
(3) Negative.

This classification will generally be based on the participant's use of emotional words that directly indicate valence category.
Sometimes there may be events that don't use specific positive or negative words but the way in which the event is portrayed or constructed will indicate the valence. However, it is important to not prescribe valence where there is none. In these cases, use your best judgment as to which Valence category the event best fits into.
If it is clear that the event contains BOTH positive and negative aspects, code the valence as "mixed".