THE ROLE OF METAMEMORY IN AUTOBIOGRAPHICAL MEMORY PERFORMANCE IN DYSPHORIC INDIVIDUALS

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Abstract

Autobiographical memory (AM) performance in individuals with depressive symptoms has repeatedly been shown to be overgeneral (OGM) in nature, and characterized by summaries of repeated events or long periods of time rather than a single event tied to a unique spatial and temporal context. The present body of work was designed to address the metamnemonic aspects of AM performance in dysphoric individuals, with the underlying motivation being that OGM may not be a unique phenomenon specific to depression or AM, and that it may reflect a more general pattern of memory impairment. The studies presented herein examine various aspects of metamemory and other memory processes that may offer a parsimonious account of OGM as poor event memory in general, rather than a specific standalone finding. In Study 1 several metamnemonic processes were investigated using a quantity-accuracy profile approach. Here, the results showed that performance between dysphoric and non-dysphoric participants was nearly indistinguishable on measures of calibration, resolution, grain-size setting, and criterion setting, suggesting that these aspects of metamemory are intact in dysphoria for immediately tested material. Study 2 examined whether it is possible to “create” OGMs by employing a delay manipulation for both autobiographical (3 day delay) and laboratory-based events (7 day delay). Indeed, the results from this study showed that the performance on both tasks declines for both groups, but that this effect was of a greater magnitude in the dysphoric group. Critically, no differences emerged for immediately tested information. Finally, Study 3 examined the role of working memory and memory search strategies in the recollection of autobiographically relevant information. The results from Study 3 showed that dysphoric individuals may engage in a less organized search strategy than non-dysphoric participants as exhibited by a tendency to switch set in the midst of thematically related information. Taken as a whole, these data indicate that OGM may be attributable to deficits in memory search strategies in conjunction with memories that may be more prone to decay and/or forgetting, suggesting that OGM may not be a depression-specific phenomenon, but rather the downstream deficit of degraded memory representation.

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Dedication

To Mom and Dad,

Thank you for instilling in me the value of education, and for encouraging me to always give it my best. You both have contributed so much to my life and words cannot express my unending gratitude.

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General Introduction

"Memory is more than just remembering" (Benjamin, 2008, p. 175). Memory is a reconstructive process (Bartlett, 1932; Schacter & Addis, 2007). If only two attributes about memory are to be taught to an aspiring psychologist, these two ideas may prove to be the most valuable. The first attribute implies that effective memory use involves a series of strategic, higher-order decision-making processes, such as how to query, or search, our memory, how to encode information so that we can better remember it at a later time, whether to withhold, or to provide an answer, and if so, deciding how much information is required in the current situation. For example, if my friend were to ask me about my weekend, I might tell him "it was nice." By contrast, if asked the same question by a police officer that showed up at my house, I would likely provide much more information. Memory, then, requires a number of control processes that vary by situation, which users can skillfully adapt based on their assessment of the situational demands. Collectively, these skillful, and strategic control processes are referred to as metamemory (Dunlosky & Bjork, 2008). Skill in memory is critically important, given that memory is indeed a reconstructive process; research has generally shown that memory fidelity is quite poor in comparison to the actual perceptual input an individual receives, and is surprisingly easy to contaminate, or corrupt (Hilgard & Loftus, 1979; Loftus & Palmer, 1974). Thus, the skillful memory user may be more aware of the limits of their memory performance, and may be able to mitigate the deficiencies by using their memory strategically.

The second attribute in the above quote, that memory is reconstructive, implies that when we recollect an event, we are not recalling an exact recording of what happened, but rather snapshots of key happenings imbued with our own sense of meaning, and biased by our culture, previous experiences, and expectations (e.g., Bartlett, 1932). Subsequent recollections of the same event may even change how we remember the event, and how it is represented in the brain (Nadel & Moscovitch, 1997). Different audiences may necessitate that we tell the event in different ways (Walker, Skowronski, Gibbons, Vogl, & Ritchie, 2009), and the reason for telling the event – to entertain, to inform, or to connect – may also affect what we decide to report, or withhold (Fivush, 2010). The two ideas that memory requires skill to use and that it is a reconstructive process can be viewed individually, but it is more helpful, and accurate, to view these ideas as a compliment to one another that interact in an iterative manner as each individual uses their memory. The focus of this dissertation is to apply these two *memory attributes* in an attempt to better understand the phenomenon of overgeneral autobiographical memory (OGM) first reported by Williams and Broadbent (1986) in their study of acutely depressed individuals. OGM is the tendency of depressed individuals to report overly vague descriptions, summarize repeated events, or summarize long periods of time when asked to report highly detailed memories (King et al., 2010). By contrast, individuals without mood disorders are likely to report one specific instance in time and place (King, et al., 2010). Similarly, OGM is characteristic of intact recollection of semantic aspects of memory (e.g., Ottawa is the capital of Canada), compared to a relatively impoverished recollection of episodic aspects of memory (e.g., I was in Ottawa on Canada day last year).

Although OGM has been primarily reported in individuals diagnosed clinically with depression, it has also be reported, albeit to a lesser extent, in individuals with subthreshold depressive symptoms, or dysphoric individuals (Williams et al., 2007). It is this group that I investigated for this dissertation. In this introductory chapter, I will review the clinical, and cognitive features of depression, with an emphasis on memory. I will provide an overview for autobiographical memory (AM) and metamemory. When possible, I will link the findings to depression and dysphoria. First, however, I will review memory research more broadly in order to help the reader orient towards the overlapping and non-overlapping terminology used in memory research proper.

Traditionalist Perspectives on Memory

Broadly speaking, memory has been viewed as a system, or a series of interconnected systems. For example, the Atkinson-Shiffrin model (1968) proposed a three-component model that included a sensory register, a short-term, and a long-term store. In this model, the sensory register is a place in which sensory information enters memory, and is to-be encoded. Here, the evidence for the sensory store comes from the classic experiments by Sperling (1963) using partial-report procedures in which participants are presented briefly with a 3 x 4 array of random letters/numbers and are given a signal either immediately, or after a delay indicating which row to remember. The data show quite conclusively that when participants are asked immediately to remember a row, their responses are highly accurate, whereas after a delay, performance falls off dramatically (Sperling, 1963). In Atkinson and Shiffrin's original paper, they cite that the sensory register, at least visually, is represented almost as a "photographic trace." Next in their model is the short-term store (synonymous with working memory), which was thought to serve as a holding place for information transferred from the sensory register, to ultimately be transferred to the long-term store, should the individual first deem the information relevant and second, rehearse the information enough. In their model, Atkinson and Shiffrin (1968) view the long-term store as a permanent storehouse for information. Oddly enough, dichotomizing memory into two stores (e.g., short- and long-term) was, at the time, considered to be an affront to traditionalist view of memory (Postman, 1964) that posited a single memory system (Atkinson & Shiffrin, 1968). Shortly after the Atkinson-Shiffrin model was proposed, psychologists were quite uncertain of the number or memory "categories," with one review suggesting at least 25 subdomains of memory (e.g., visual short-term memory, acoustic short-term memory; Norman, 1970). Even though the Atkinson-Shiffrin model is considered outdated, it is still important because it was the first model that placed an emphasis, via the short-term store, on the role of the rememberer, and on controlled processes in the activity of remembering something. Historically these were variables that were viewed as nuisances to experimental psychologists that had to be controlled, rather than as something worth investigating in and of itself (Goldsmith & Koriat, 2008), and as such the Atkinson-Shiffrin model may have been an early pioneer in the field of metamemory.

Indeed, in the years following, Baddeley and Hitch (1974) proposed a model of working memory that elaborated upon the short-term store proposed by Atkinson and Shiffrin (1968). Initially, Baddeley and Hitch (1974) proposed that a central executive, a sort of overseer of cognitive operations, was responsible for the regulation of cognitive processes, including the coordination of subservient cognitive operations that function only as short-term stores: the phonological loop and the visuospatial sketchpad. In 2000, Baddeley added the episodic buffer as the final subservient system. Each of these subservient systems functions as one would imagine: the phonological loop is theorized to be a location used for the rehearsal of auditory information, the visuospatial sketchpad is used for visually presented information, and the episodic buffer is thought to integrate information temporally, and to act as a bidirectional waypoint to and from semantic memory. In this conception of memory, Baddeley and Hitch placed an even greater emphasis on the control and regulation of cognitive processes than previous models.

These two models focused more attention on the early stages of memory encoding, rather than on the storage or the architecture of long-term memory. Of course, the organization of memory and memory storage are equally important for proper memory functioning, and as such, theorists soon attempted to purport and research various conceptions/models of storage. Most germane to the present discussion, a book published in 1972 entitled *Organization of Memory* (Tulving, Donaldson, & Bower, 1972) provided a foundational understanding of memory architecture. Specifically, Tulving (1972) ultimately informed psychologists' understanding of memory systems through to the present day. Tulving (1972) synthesized the existing empirical literature on memory and credited Quillian (1966) for introducing the term *semantic memory*, which at the time was thought to encompass a variety of cognitive operations such as the ability to memorize facts, solve problems, use deduction, and understand ideas (Rumelhart, Lindsay & Norman, 1972). Semantic memory was also thought to represent one's knowledge of language that serves as a foundation for all information processing (e.g., cognition; Kintsch, 1972), or a structured network of concepts, words, and images that make it possible to infer meanings between concepts and language (Collins & Quillian, 1972).

Tulving (1972) argued that although the term semantic memory was useful as a superordinate conceptualization of memory that could serve as a unitary memory system (rather than another category of memory), it was unclear what kind of memory was *not* semantic. He pointed out that knowing what a term includes is just as important as knowing what a term excludes, and introduced the term *episodic memory* as the kind of memory that is not semantic memory. For ease of communication, Tulving (1972) presented semantic and episodic memory as two systems of memory, but remained agnostic as to whether any functional or neuroanatomical differences existed between each system; instead, Tulving's goal in distinguishing between episodic and semantic memory was to provide a foundation for the construction of memory theories. Tulving (1972) wrote:

> The distinction between episodic and semantic memory systems should not be construed as representing the beginning of some new theory of memory. Rather, the point of view of the two as separate systems represents an orienting attitude or a pretheoretical position whose major usefulness may turn out to lie in facilitating theory construction, without in any way circumscribing the nature of possible theories. In some sense, the distinction parallels that between sensory and perceptual processes…No one will seriously want to deny that both sensory and perceptual processes are involved in an organism's awareness of its environment, that sensory processes may be influenced by perceptual processes and vice versa, and that, nevertheless it frequently makes good sense to talk about laws and principles governing one set of phenomena independently of those applicable to the other. I envisage a similar status for the distinction between episodic and semantic memory. (p. 384-385)

Episodic memory, then, is defined as temporally and spatially bound events that are consciously *remembered or re-experienced*, whereas semantic memory is organized knowledge that has no associated temporal "tag," and it includes general world knowledge (e.g., Ottawa is the Capital of Canada), language, and words and their meanings. Semantic memory, however, can include temporal information, such as one's birthdate, or knowing that New Year's Eve is on December 31^{st}. They key distinction here is that any temporal information in semantic memory does not have a unique occurrence associated with it. That is, it is unlikely that anyone remembers when they learned that New Year's Eve is on December 31^{st} (semantic), whereas they could remember what they did last New Year's Eve (episodic). Later, Tulving also proposed a third memory system, procedural memory, to encompass skill-based learning that included motor skills, as well as perceptual and cognitive skills (Tulving, 1983).

As Tulving's conception of episodic and semantic memory began to garner support by empirical work, his model became more nuanced. Tulving (1985) later began to examine the relation, and interaction between memory and consciousness, which led him to propose three types of consciousness: autonoetic, noetic, and anoetic. Autonoetic (self-knowing) consciousness is associated with episodic memory. It is required for the rememberer to truly remember a temporally and spatially specific memory (e.g., that time I got lost at the zoo); it is often referred to as one's ability to mentally time-travel, either backwards or forwards in time, to re-experience or imagine a future event (Schacter & Addis, 2007). Noetic consciousness is associated with semantic memory and does not require true remembering as a knowledge state, but rather refers to *knowing* as a knowledge state. For example, everyone knows that they were born (semantic, noetic), but no one remembers *being* born (episodic, autonoetic). Finally, anoetic consciousness is associated with procedural memory and is bound to the present. For example, riding a bike does not require the recollection of previous bike rides, but rather an awareness of one's body position, balance, and speed amongst other kinesthetic factors account for anoetic consciousness.

The distinction between episodic and semantic memory has stood the test of time, and has been supported by an abundance of behavioural, neuropsychological, developmental, and imaging literature (Fivush, 2010; Gardner & Java, 1991; Levine, Svoboda, Hay, Winocur, & Moscovitch, 2004; Parkin & Walter, 1992; Tulving, 1985). Not surprisingly, however, critics have argued against Tulving's distinction between episodic and semantic memory as separate systems. Some claim that since both memory systems are dependent on intact hippocampal functioning, they should be subsumed under the system known as declarative memory (Squire & Zola-Morgan, 1991). Regardless of this theoretical disagreement, research to date largely supports the notion that episodic and semantic memory are indeed dissociable, yet interacting and overlapping memory systems.

Modern Memory Consolidation Theories

Modern memory theorists still rely heavily on the distinction between episodic and semantic memory, and have attempted to explain behavioural and neuropsychological patterns in patients with various forms of neurological damage (e.g., dementia, traumatic brain injury) that result in retrograde amnesia (Nadel & Moscovitch, 1997; Nadel, Samsonovitch, Ryan, & Moscovitch, 2000; Squire, 1992; Squire & Alvarez, 1995). It seems that modern theorists are less concerned with identifying types of memory, and are more interested in determining how memory is stored, consolidated, and retrieved. Here, I will focus on two models of consolidation: The Standard Consolidation model, proposed by Squire (1992), and the Multiple Trace Theory (MTT) proposed by Nadel and Moscovitch (1997). Both of these models argue for a special role of the hippocampus, and the medial temporal lobe (MTL) more generally, albeit in different capacities.

In the Standard Consolidation model, the hippocampus acts as a temporary memory system that ultimately leads to the long-term consolidation of a memory that is distributed (stored) permanently in various areas of the neocortex (Squire, 1992). The hippocampus receives information from the neocortex, which initiates a short-term consolidation process that lasts from seconds to tens of minutes (Squire, 1992). Once short-term consolidation is complete, long-term consolidation begins immediately, which still relies on the hippocampus for storage and retrieval operations. Over time, however, the role of the hippocampus becomes less integral, and eventually non-existent for memory storage and retrieval, as the memory becomes organized in the neocortex in domain-specific areas (e.g., visual information retrieved from visual processing areas; Squire & Alvarez, 1995). The standard consolidation model posits that the retrieval of remote memories is mediated entirely by the neocortex. Importantly, this model of memory consolidation distinguishes only between recent and remote (old) memories, and makes no claim for the existence of episodic or semantic memory.

The MTT, by contrast, proposes that the hippocampus is always required for the storage and retrieval of episodic memories, regardless of the memory's age (Nadel &

Moscovitch, 1997). This postulate of the MTT is the main point of divergence from the standard model. According to the MTT, semantic memory is stored elsewhere in the brain. Other points of divergence include that the MTT claims that each re-activation of a memory trace (e.g., act of remembering) occurs in a different neuronal and experiential context that ultimately creates a new neuronal trace (Nadel & Moscovitch, 1997). By necessity, the new neural trace shares some (or almost complete) overlap with previous neural traces, but also some new traces that result from the different context(s) in which the memory was retrieved. The new memory trace undergoes the same process of consolidation as the previous trace, which allows for a wider distribution of the memory trace in the brain. Semantic information, then, is gleaned from each episode but stored independently of the hippocampus, which may account for the robustness of semantic memory after neuronal injury (e.g., Damasio, Eslinger, Damasio & Van Hoesen, 1985). The core temporal and spatial component of episodic memory always requires the interaction between the hippocampus and the frontal cortex (Nadel & Moscovitch, 1997).

Episodic Future Thinking: Memory as a Reconstructive Process

In recent years, researchers have turned their attention to one of Bartlett's (1932) original claims that memory is largely a reconstructive, rather than reproductive, process (e.g., Schacter & Addis, 2007; Schacter, Benoit, De Brigard & Szpunar, 2015). Two questions motivating this line of thinking are, "What is the role of memory?" and "Why might it have evolved?" Remembering an event in and of itself can be a pleasant experience, and it may serve as a social bonding mechanism (Walker et al., 2009), but from an evolutionary perspective, it is not essential for survival. Instead, the major adaptive advantage that memory may have provided us is to use our past experience to predict possible future outcomes without having to blindly go into a situation. For example, I may be more careful about wandering into the wilderness at night if I have previously witnessed a vicious animal in the evening. Similarly, I may be more well-equipped, or better prepared to deal with such an attack were it to occur. Thus, the main advantage of a memory system is not to simply recall and relay events (which is still a benefit), but to allow us to predict potential future events, and maximize our chances of surviving such events (Suddendorf & Corballis, 2007).

Indeed, neuroimaging, and neuropsychological data indicate that there is a substantial overlap in the neural underpinnings of episodic memory and episodic future thinking (Addis & Schacter, 2008; Schacter & Addis, 2007; Szpunar, Chan, & McDermott, 2009; Szpunar, Watson, & McDermott, 2007). Addis and Schacter (2008) found that remembering detailed past events and imagining the future events both involve areas of the left MTL, including the posterior hippocampus and the parahippocampal gyrus. The left anterior hippocampus, however, appears to be preferentially involved when imagining future events, compared to recollecting past events (Addis & Schatcer, 2008). This same study found an interesting pattern of neural activity based on the temporal distance of the event being remembered, or imagined: for recent life events, participants exhibited approximately the same amount of hippocampal activity compared to remembering remote life events, whereas imagining distant future events required *greater* hippocampal activity compared to imagining nearer future events. Importantly, the simulation of future episodic events appears to be distinct from the simulation of future events in general. Szpunar, Watson, and McDermott (2007) had participants imagine future events happening to themselves, or to a famous person (ex-President Bill

Clinton). Although the neural activity was similar across tasks, the degree of activation for imagining events happening to oneself was much greater compared to events that may happen to Bill Clinton, suggesting that the involvement of the self is especially important to episodic memory (Szpunar et al., 2007).

Based on several imaging studies, a core network has been proposed for episodic memory and episodic future thinking: MTL, medial prefrontal cortex, posterior cingulate, retrosplenial cortex, and lateral temporal and prefrontal regions (Schacter, Addis, & Buckner, 2007). In support of this core network, neuropsychological findings have shown that patients with damage to the MTL, especially the hippocampus, exhibit great difficulty when attempting to imagine novel future events (Hassabis, Kumaran, Vann, & Maguire, 2007). Taken together, these findings suggest that the MTL, and most prominently the hippocampus, is not only involved in remembering the past, but also in imagining the future. This view on memory as reconstructive and involved in planning processes seems to make intuitive sense from an evolutionary perspective.

In 2007 Schacter and Addis proposed the constructive episodic simulation hypothesis based on the findings above, which has since garnered substantial empirical support. The constructive episodic simulation hypothesis states that "the constructive nature of episodic memory is attributable, at least in part, to the role of the episodic system in allowing us to mentally simulate our personal futures" (Schacter & Addis, 2007, pp. 778). The authors are careful to point out that their hypothesis does not state that episodic memory only plays a role in future thinking, but rather, that simulation is just one of its major roles (one might make the argument that recollection of a past event is a simulation in and of itself). If this hypothesis is taken to be true, it offers a fair amount of explanatory value as to why human memory is so fallible. Behavioural data has tended to support the constructive episodic simulation hypothesis, in that the qualitative aspects of recollecting past and imagining future events tend to be quite similar. D'Argembeau and van der Linden (2004), for example, had participants recollect positively and negatively valenced past and imagined future events at various temporal distances. The results from their study showed that past events were recollected with more vivid sensory and perceptual details than were imagined future events. Interestingly, the effect of emotion remained constant for both past and future events: positive events were subjectively re-experienced and pre-experienced to a greater degree than negative events (D'Argembeau & van der Linden, 2004). Further, participants reported more sensory and perceptual details for events that were temporally close, regardless of temporal direction; as events became more temporally distant, participants exhibited greater difficulty in generating details.

In a more recent line of work, researchers have begun to examine the relations among episodic memory, future simulation, and episodic *counterfactual* thinking, along with the neural underpinnings (De Brigard & Giovanello, 2012; Schacter, Benoit, De Brigard, and Szpunar, 2015). Episodic counterfactual thinking involves imagining an event that could plausibly have happened in one's past, but did not in fact occur. To examine the relation between these three types of episodic memory and episodic counterfactual thinking, De Brigard and colleagues conducted an imaging study that required participants to either recall positive or negative events, or to engage in counterfactual thinking that either made positive events negative, or negative events positive; finally, participants also had to recall events with a peripheral detail changed, so that the valence of the memory remained stable (De Brigard, Addis, Ford, Schacter, & Giovanello, 2013). In order to address a shortcoming in the literature, one key manipulation in this study was that participants had to estimate the likelihood that each counterfactual event could have actually happened. This study found that the core network of brain regions associated with episodic simulation, described above, was active for positive and negative counterfactual thinking, and for episodic recollection. Interestingly, in a partial least squares analysis a latent variable distinguished recollection and likely counterfactual events from unlikely counterfactual events. Further, plausible counterfactual events, regardless of whether the emotional valence of the event was experimentally switched, exhibited neural activity closely associated with remembering truly experienced events, whereas implausible counterfactual events recruited a network more similar to imagined future events. These findings suggest that the most parsimonious role of the core brain network is to construct episodes, regardless of their temporal direction or veracity, essentially specializing as an episodic simulation process.

Schacter and colleagues (2015) take this line of thinking one step further in proposing that if the core network is primarily involved in episodic simulations, then it may be involved in our decision-making process for current and future events. For example, one study required participants either to imagine a specific episode of spending money (£35) in a pub in the future, or to estimate what one could buy with the money in that scenario (Benoit, Gilbert, & Burgess, 2011). After simulating the future event or estimating what they may purchase, participants had the option to choose an immediate reward of £25, or a delayed reward of £35 in 90 days; for decisions that followed the simulation, participants were much more likely to choose the delayed reward (Benoit et al., 2011). This is in contrast to typical findings that show our tendency to devalue rewards after a delay (e.g., Green & Myerson, 2004). Benoit and colleagues (2011) suggest that having participants simulate future events makes it seem as if the event is more likely to happen, or it may increase positive feelings towards a given event, which allowed participants ultimately make a better financial decision (Benoit, et al., 2011). Indeed, fMRI data from this study indicated that part of the core network mediated the effect of episodic simulations on future decisions such that individuals with a greater degree of activity here were more likely to choose the greater reward. Thus, it appears that the core network may play a role in decision-making.

Autobiographical Memory

One consistent theme that emerges across definitions of AM is that it is a storehouse of memories that an individual has of their life and experiences, and that it is goal directed and serves to define our purpose in life (Fivush, 2010; Robinson, 1989). AM has been conceptualized as both separate from episodic memory (Fivush, 2010), as a superordinate category of episodic memory (Conway, 2005), and as a subordinate category of episodic memory (Tulving, 1972). Presently, is it not entirely clear how to best distinguish between episodic and AM. Some authors argue that unlike episodic memories, AMs have some bearing on an individual's selfhood (Conway, 2005). In fact, Brewer (1986) proposed that the self-referring nature of AM is what separates it from all other types of long-term memory. For example, any given drive to work may be an episodic memory, but if one particular drive to work involved a serious motor vehicle accident that resulted in months of physiotherapy and rehabilitation, that specific memory would be autobiographical due to the fact that it would likely contribute to an individual's sense of self.

The self-memory system. One model of AM is Conway's (2005) self-memory system (SMS), which is organized as a partonomy (deals with part-whole relationships) rather than a taxonomy. In this model, the authors point out that there is no "direct" correspondence between their conception of AM and Tulving's (1985) episodic memory, as they suggest it introduces artificial divisions (Conway & Pleydell-Pearce, 2000). In the same article, however, these authors go on to suggest that their SMS is "highly compatible" with the view of episodic memory requiring autonoetic consciousness, so the overlap between Tulving's theory and Conway's SMS is not entirely clear. Regardless, under the SMS model, memory is thought of as a database of information about oneself. Embedded within the SMS are two major components: the working self and the AM knowledge base (Conway, 2005). According to Conway and Pleydell-Pearce (2000), autobiographical remembering can only occur when the working self and the AM knowledge base work together. Each system, however, can operate on its own. The working self is a part of the working memory system (Baddeley, 1986) that maintains currently active goal hierarchies that are continually updated as an individual makes progress toward a given goal. The AM knowledge base is a long-term memory store that contains both episodic memories (e.g., first day of school) as well as semantic autobiographical knowledge (e.g., birth year). The AM knowledge base is further divided to include an individual's "life story," at the superordinate and most abstract level. Directly beneath this level in the hierarchy are "themes," which include overarching and pervasive areas of an individual's life. For example, a theme may be related to family, or career (Conway, 2005). Embedded within themes are "lifetime periods", which can include age ranges (e.g., "teens") or other ways of dividing time (e.g., "while attending university"). Underneath this level of autobiographical knowledge are "general events" that include repeated instances of particular happenings, such as family dinners. According to Conway and Pleydell-Pearce (2000), an individual searches their autobiographical knowledge base for specific memories in a stepwise fashion beginning at lifetime periods, through to general events, and finally terminating their search once event-specific knowledge has been retrieved (see Figure 1). The organization of the SMS makes the retrieval of specific memories dependent on cues at each level of the partonomy; importantly, however, the cues do not necessarily have to exist at each level in order to recollect a specific event. For example, it would not be necessary to know that during my twenties (lifetime period), I started going to Ryerson (general events). Rather, it is possible just to recall that I went to Ryerson without consciously recollecting my twenties. Of course, recollecting my twenties in addition to my attending Ryerson during that timeframe would create a much richer, vivid memory.

Conway and Pleydell-Pearce (2000) propose that the working self – a cognitive control process that coordinates other cognitive operations – uses its online goal structures to encode relevant autobiographical events, and the working self is once again recruited at recollection. Broadly speaking, these goal structures aim to reconcile discrepancies within one's own self-concept and the goal structures of the working self refer largely to what Higgins (1987) conceptualized as three states of self: the actual self, the ideal self, and the ought self. In Higgins' (1987) model, the actual self is the representation one holds about oneself that most closely reflects one's self in reality, the ideal self is the representation of what one desires to become, and the ought self is the representation of what one should be as specified by others (society, partners, family

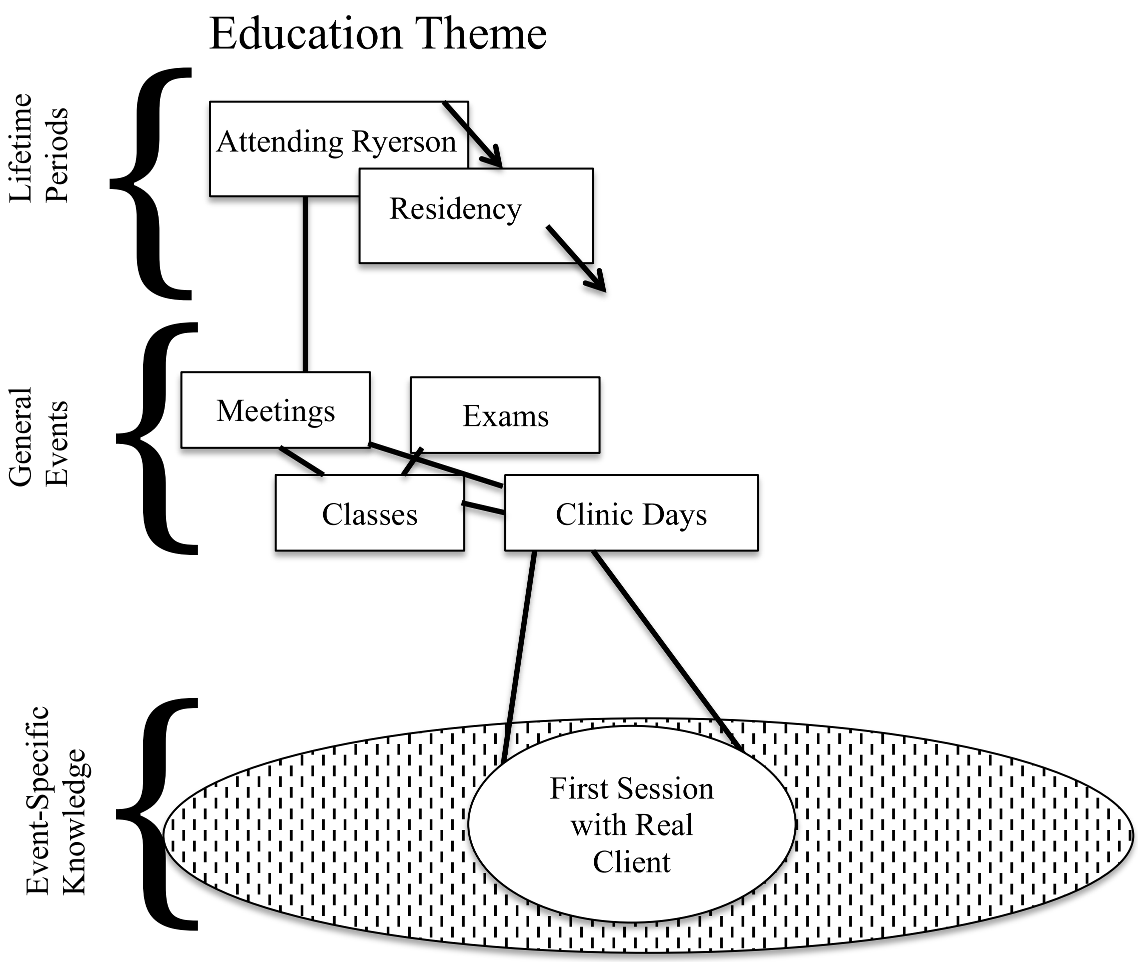

Figure 1. The self-memory system illustrated. The lined oval in Event-Specific Knowledge represents a pool of features that are activated by search cues at the General Events level. Adapted from Conway & Pleydell-Pearce, 2000.

members). The ultimate goal of the working self, then, is to keep in mind, and reconcile any discrepancies that arise between these states of selfhood in order to achieve the ideal self, which theoretically is an iterative, and ever-evolving process (Conway & Pleydell-Pearce, 2000). Importantly, the discrepancies between states of self are thought to create negatively valenced emotions that motivate an individual to seek a resolution. Some authors propose that discrepancies among states of self have developmental histories that tend to arise from early childhood experiences and, much like Beck's (1976) conception of schemas, serve to bias information processing when a given discrepancy (or schema) is activated; similarly, these discrepancies tend to be strongly held beliefs (Strauman, 1996). When an individual fails to reconcile the goals of the working self with their existing AM knowledge base, it may lead to a disruption in the SMS, and potentially to a pathological state such as confabulations in frontal patients, or delusions in schizophrenia (Conway & Pleydell-Pearce, 2000).

Autobiographical memory across development. According to Nelson and Fivush (2004), AM is a system of memory that emerges dynamically in a gradual fashion in preschool years. They propose that AM relies on the development of language, narrative comprehension, "memory talk" with parents, general memory abilities (e.g., short-term and long-term memory), understanding of self and others, and an understanding of temporal relations, amongst other variables. Theoretically, Nelson and Fivush (2004) view episodic and semantic memory as subcategories of declarative memory. Nelson and Fivush (2004) define AM as a declarative memory that occurred at a specific time and place in one's own personal past, that is recalled from one's unique perspective of oneself in relation to others. AM is thought to unfold in the context of the dynamic developmental systems theory (Fischer, 2000; Oyama, 1985), which places a strong emphasis on each individual's social environment, and history, because the system itself is an ever-changing phenomenon based on previous input. Further, because the development of cognitive processes unfolds in a gradual manner, as children age they gain access to larger pieces of the AM puzzle that they must assemble based on their unique individual cognitive operations, and past experiences. Clearly, this is a complicated matter.

In Nelson and Fivush's (2004) theory, they propose that AM is the result of episodic and semantic memory that forms at some point after infancy. They suggest that AM differs from memory in infancy based, at least in part, on the fact that AM can be self-cued (e.g., choose to tell a story), whereas memory in infancy requires external and internal cuing (e.g., Bauer, Wenner, Dropik, & Wewerka, 2000). External cuing refers to a stimulus-response relationship, in which an external stimulus cues a memory response (e.g., see mother make a silly face, respond in turn with similar expression), whereas internal cuing refers to a trigger such as hunger, and recognizing that one's mother is usually the provider of nourishment. Importantly, Nelson and Fivush (2004) recognize that not all forms of personal memory are autobiographical. Rather, they cite the work of Nelson (1978), and Schank and Abelson (1977), related to scripts as a form of personal memory that is not autobiographical in nature. Strong evidence illustrates that even young children can have fairly elaborate scripts for daily events (Nelson, 1986). From an evolutionary perspective, scripts developed early in life (or earlier in our evolution) because they served as a generalized memory system that conferred some kind of evolutionary advantage. For example, our ancestors would benefit greatly from a script for foraging for the correct fruits, whereas a memory for one specific event related to fruit-picking might be less useful. Here, the generalized system would reign supreme as a pragmatic memory system, thus developing earlier. The development of the specific memory system (episodic memory) likely came later in evolution, and was tied to the development of language (Corballis, 2003). According to Nelson and Fivush (2004), AM likely developed even later in evolution. They contrast episodic memory and AM on the basis of the distinct neural circuitry associated with episodic memory, and posit that although AM shares substantial overlap with said circuitry, it emerges more as a result of the interaction of that circuitry in the context of social, cultural, cognitive and communicative domains (Fivush, 2010; Nelson & Fivush, 2004). Here, it is theorized that there are interactions between the episodic memory network and the brain networks supporting these other domains, along with a co-occurring development of the system in a given socio-cultural context.

Critical to the social cultural developmental theory of AM (Nelson & Fivush, 2004) are three postulates: AM emerges gradually, language is a critical tool for the development of AM, and AM is characterized by substantial individual, cultural, age, and gender differences. Although a full review of their theory is beyond the scope of this dissertation, a brief review will be provided. The first inputs received by an infant are social interactions framed within their social and cultural context, and largely informed by the social/cultural context in which their parents developed (Nelson & Fivush, 2004). Based on these interactions, the infant forms two critical concepts: intentionality of self and others (Tomasello, 1999), and a sense of self (Damasio, 1999). Intentionality refers to an individual’s ability to recognize that they, and others, act towards a goal, whereas the sense of self refers to the idea that infants may recognize their own goals as distinct from the goals others hold.

Slowly, the infant begins to be able to form memories for routines (e.g., Bauer et al., 2000), and the development of language becomes critical to progress towards forming memories for events (Nelson & Fivush, 2004). As reviewed by Nelson and Fivush (2004), only with the development of language can an individual form a “cognitive” self, which refers to recognizing oneself as uniquely “me”. The suggestion here is that without language, it would preclude a linguistic label for term “me” which is a crucial distinction between self and others; without the concept of “me” the self is indistinguishable. In a normally developing child, language development is necessary for forming event memories and a sense of a “cognitive” self typically emerge by age two (Nelson & Fivush, 2004). At this point in development, Nelson and Fivush (2004) suggest that since toddlers can understand the relation between language and events, parents naturally begin talking to their toddlers about past and future events, to begin instilling an understanding of temporal relations. The characteristic way that parents, especially mothers, tell stories and ask questions to their toddlers ultimately affects the way toddlers, and children eventually organize and share their AM (Harley & Reese, 1999). This latter point is critical to the development of AM, as children are not only learning about events and their temporal relations, but also about what information is typically valued by their community. Here, a positive feedback loop forms between the information valued, and the way in which narratives are shared between the story teller and audience, in which the sharing of valued information aids in the understanding of a complete, rather than a fragmented, episode. Thus, maternal narrative style has a major influence over the development of AM in toddlers and children, which remains stable across the preschool years (Harley & Reese, 1999). These unfolding cognitive processes interact and intersect over time in the infant's culture, and social groups to fuel the ongoing development of AM.

It seems clear that AM does not emerge in a binary fashion, such that one day it is absent, and the next it is present. Instead, as Fivush (2010) suggests, it develops over time based on the context, culture, and social group one experiences. Although much more could be said about the development of AM across the lifespan, the above provides a cursory overview of the complicated process in order to give the reader a perspective on the recent state of the literature.

Empirical Literature Summary

To date, theorists have developed many conceptual models and taxonomies of memory functioning in humans. An exhaustive review of memory as a whole is beyond the scope of this dissertation, but the above literature review aimed to provide a fairly thorough overview of the development and current understanding of leading memory theories. Early memory theorists focused their efforts on understanding the early stages of memory processing (e.g., encoding; Atkinson & Shiffrin, 1968) while placing little emphasis on the storage and retrieval aspects of memory. Only in the 1970s did theorists begin trying to understand how memory is organized, which led Tulving (1972) to propose a framework of memory involving episodic and semantic components. Tulving (1985) later incorporated three types of consciousness (noetic, anoetic, and autonoetic) into his proposed framework to further distinguish between episodic and semantic memory.

In the 1990s, some researchers began integrating Tulving's (1972, 1985) distinction between episodic and semantic memory into models of memory consolidation. Specifically, Nadel and Moscovitch (1997) proposed the MTT that was able to clearly account for the pattern(s) of memory impairment after neurological insult or injury that commonly presented as impaired memory for specific events, but relatively spared memory for general world knowledge. In this model, the hippocampus is always required for the recollection of episodic memories. Other authors, however, disagree with the notion that the hippocampus is required in the recollection of memories (e.g., Squire, 1992) and instead propose that it acts as a temporary store that serves as a waypoint to long-term storage in relevant neocortical areas (e.g., visual information stored in the visual cortex). Squire's Standard Consolidation model disagrees with the distinction between episodic and semantic components of memory, and instead focuses on recent and remote memories. This dissertation is informed in part by the work of Tulving (1972, 1985), and Nadel and Moscovitch (1997), and thus places an emphasis on episodic and semantic components of memory, especially in the context of AM.

More recently, researchers have begun to examine the overlap between memory and event simulation, along with the underlying neurological circuitry (e.g., Schacter & Addis, 2007). This work is motivated by the notion that memory is reconstructive in nature (Bartlett, 1932), and it appears that the shared neuroanatomical network between memory and simulation is substantial. Taken together, this overlap ultimately suggests that memory is not just for remembering, per se, but also for predicting likely outcomes of future events.

The study of AM relies on the abovementioned aspects and models of memory processes and is the primary subject of this dissertation. Of most relevance, AM draws its theoretical and conceptual underpinnings from a variety of domains of memory and attempts to integrate them into what may be most commonly referred to as “every day” memory, or memory for real life events. Next, an overview of metamemory is provided.

Metamemory

In recent years, it has become increasingly clear that memory performance involves the strategic control and regulation of search, storage and report processes (Goldsmith & Koriat, 2008). Collectively, these processes are referred to as metamemory. Metamemory is a subdomain of metacognition, which allows us to think about our thoughts and to strategically put them to use to regulate behaviour and to achieve goals (Dunlosky & Bjork, 2008; Koriat, 2007). In both metamemory and metacognition, the “meta” aspect refers to the ability to strategically use either our memory or other forms of cognition in a flexible manner that is guided by higher level decision-making on both the inputs and outputs from conscious thought (Benjamin & Ross, 2008). Research on metacognition has its roots in educational/developmental psychology (Flavell, 1971,1979), but has also drawn researchers from diverse areas of study including cognitive psychology (Koriat & Goldsmith, 1996b; Nelson & Narens, 1990), forensic psychology (Pansky, Koriat, & Goldsmith, 2005), and social psychology (Schwarz, 2004), amongst other areas. Philosophers, too, seem quite interested in the study of metacognition, and suggest that it offers a link between consciousness, thought, free will, and behaviour (e.g., Nelson & Ray, 2000).

The first theoretical model for metamemory was proposed by Nelson and Narens (1990), who organized existing metamnemonic paradigms according to the stage of memory it related to: acquisition, retention, or retrieval. Nelson and Narens (1990) added that cognition occurs at two different, yet overlapping levels: the object level and the meta-level. In this model, the object level of cognition refers to "basic" cognitive operations such as attention, encoding, and retrieval (Koriat, 2007; Nelson & Narens, 1990), whereas the dynamically operating meta-level – like an overseer – refers to the monitoring and controlling of these basic processes, and operates in a top-down fashion in order to ensure that current goals are actively being pursued. To illustrate, if someone was reading of list of 10 words with the goal to remember as many words as possible, the object level would be responsible for attention, reading comprehension, semantic analysis and so on, whereas the meta-level would be involved in strategically organizing the words into clusters to facilitate memory. In addition to strategically organizing information, the meta-level is always proposed to be involved in the decisions/judgments that individuals make about their learning (Koriat, 2007). The model proposed by Nelson and Narens (1990) offered a conceptual framework, and provided a common language for metamemory researchers to use when discussing their findings, and as such the vast majority of researchers in this field have adopted it. More recent models will be explored later in this document, but first, a broader discussion of some key aspects of metamemory will follow.

Memory Metaphors

It seems obvious what one means when they refer to the concept of memory: to remember something. Once memory became a topic of experimental investigation, however, it became clear that researchers studying the same phenomenon were not studying the *same aspects* of memory (e.g., Ebbinghaus, 1913; Neisser, 1978). In one camp, researchers were interested in quantifying memory performance by using lists or non-sense words (e.g., Ebbinghaus, 1913), while the other camp aimed to study memory for real-life events (e.g., Neisser, 1978). At first glance, this may seem like truly overlapping categories of study, but upon closer inspection, it is clear that these two streams of memory research are focused on different questions: researchers have disagreed on *what* contents of memory should be studied, *how* memory should be studied, and *where* it should be studied (Koriat & Goldsmith, 1996a). In brief, should memory researchers study lists or real-life events (what)? Should they conduct studies with tightly controlled variables or investigate memory in naturalistic settings (how)? Should research be conducted in the laboratory, removed from motives and social situations, or in an environment where individuals are allowed freedom over the situation (where)? Of course, these dimensions of memory are related to one another, but each camp of researchers may vary on their stance across the what, how, and where. According to Koriat and Goldsmith (1996a), the fundamental difference between these camps of researchers is the *memory metaphor* each camp implicitly supports. They state:

> These metaphors, the *storehouse* and *correspondence* metaphors, embody two essentially different ways of thinking about memory and how memory should be evaluated. The storehouse metaphor, which likens memory to a *depository* of input elements, implies an evaluation of the *number* of items remaining in store.

> In contrast, the correspondence metaphor, which treats memory as a *perception* or *description* of the past, implies an evaluation in terms of the *accuracy* or *faithfulness* of that description. (Koriat & Goldsmith, 1996a, p. 168).

The storehouse metaphor implies that memory is something that can be *counted*, whereas the correspondence metaphor implies that memory can be *counted on* (Goldsmith & Koriat, 2008). This distinction led Koriat and Goldsmith (1994, 1996a) to develop quantity-oriented and accuracy-oriented approaches in their study of memory, which I explore in the next section.

Quantity- and Accuracy-Oriented Approaches

The quantity-oriented approach to memory is synonymous with the storehouse metaphor, and it implies that the most important aspect of memory is its countability; that is, items on a list can be counted. For example, standard neuropsychological tests are typically concerned with how many words from a list are recalled by a participant. In this approach to memory research, forgetting is thought of as the loss of information – items that are input but not output by the participant are considered "forgotten." Koriat and Goldsmith (1996a) consider this approach to be input-bound because researchers are primarily interested with how much of the input into the memory store is reported and individuals are held accountable for items they do not report. By contrast, the accuracy-oriented approach to memory is concerned with how well a memory corresponds to an event that occurred (Koriat & Goldsmith, 1996a). Research on everyday memory, including AM, views memory according to the accuracy-oriented approach in which there is an inherent truth-value associated with the output from memory stores. Forgetting in the accuracy-oriented approach is thought of differently too: instead of a loss of information, forgetting is seen as a loss of correspondence between the event and the report based on the event. Unlike the quantity-oriented approach, the accuracy-oriented approach places importance on the content of memory. For example, forgetting the word "knife" on a list of ten words is treated no different than forgetting the word "milk" in the quantity-oriented approach; however, in the accuracy-oriented approach, forgetting that an accused assailant of a crime had a knife is of critical importance (Koriat & Goldsmith, 1996a).

In contrast to the input-bound nature of the quantity-oriented approach, the accuracy-oriented approach is output-bound, meaning that the output is critical to performance. Individuals are held accountable for what they do report or how well their output matches what was input. As an example of the difference between input- and output-bound, imagine someone picks up eight out of ten items from their grocery list they left at home. On quantity measures, they would have correctly recalled 80% of their list, and if each item were indeed on the list, their accuracy would be 100%. If, however, the person picked up nine items but one was *not* on the list, their quantity performance would still be 80% (as most quantity-based measures are not concerned with commission errors), but their accuracy would decrease to 88% (Koriat & Goldsmith, 1996b). More succinctly, quantity measures are equivalent to correctly remembering an input item (an item on the grocery list) whereas the accuracy measure is whether the reported item is correct (actually on the grocery list). In summary, the quantity-oriented approach is concerned with *how much* is remembered whereas the accuracy-oriented approach is concerned with the *content* that is remembered. Although these approaches to memory have often been at odds, newer methods have been developed that allow for their integration, as will be described later (e.g., Quantity-Accuracy Profile (QAP) methodology; Goldsmith & Koriat, 2008).

Task parameters. Quantity and accuracy memory are critically affected by the experimental variable of report option (Koriat & Goldsmith, 1996b). Under conditions of forced-report, in which participants are required to answer all items, measures of quantity and accuracy are equivalent. By contrast, under free-report conditions quantity and accuracy performances may differ substantially as participants have the option of withholding or disclosing information at their discretion, as is most commonly the case in real-life (more on this later). The reason for this is that under free-report conditions, participants are allowed some degree of control over their responses and are subsequently more likely to volunteer information they believe to be accurate (Koriat & Goldsmith, 1996b). As a result, this can lead to very different accuracy and quantity performance, especially because the number of answers volunteered is likely to be lower than the amount of information input.

Although there exists a vast literature on recall versus recognition, report option is an understudied area in the memory literature as an experimental variable. Instead, report option is often treated as a nuisance variable (e.g., Koriat & Goldsmith, 1994). However, it is partly responsible for the finding that in naturalistic settings, recall performance is superior to recognition, whereas in laboratory settings, recognition performance is usually superior to recall performance. This observation is referred to as the recall-recognition paradox and has been shown to be the result of confounding memory property (quantity and accuracy) along with test format (production and selection) and report option (free and forced). In one study, a series of experiments were designed to examine the influence of each of these variables (memory property, test format, report option) on memory performance (Koriat & Goldsmith, 1994). Test format is an experimental variable that determines how responses will be gathered. In production tests, participants are allowed to produce answers however they choose as is the case in free recall; that is, there are no constraints placed on the participants' potential responses. On the other hand, selection tests constrain participant responses by providing clear options from which the participants can choose, as is the case for multiple-choice questions. Between these two ends of the test-format spectrum are cued recall and directed questioning that both impose some degree of constraint over the responses participants can make (Koriat & Goldsmith, 1994). Much research on this particular experimental variable has been conducted in eyewitness testimony studies, and it has been clearly shown that the way in which questions are posed have a significant impact on the subsequent responses. For example, Hilgard and Loftus (1979) showed that free recall interviews typically elicit greater accuracy, but fewer details; conversely, directed questioning elicits more details but with less accuracy. Other research has shown that the wording of questions can also influence participant responses. To illustrate, one study asked participants to estimate the speed of two cars prior to an accident (Loftus & Palmer, 1974). Two groups of participants read the same question with one word change: one group read that the cars "smashed" into each other, while the other group read that the cars "bumped" into each other. The first group estimated that the cars were going significantly faster than the second group. Overall, then, it is clear that test format is a crucial variable in memory research.

Report option (e.g., free vs. forced) is a variable that interacts with test format (e.g., recall – production vs. recognition – selection). Briefly, report option can either freely allow participants to withhold information or force them to report information. When combined, report option and test format create four possible response formats: forced production, forced selection, free production and free selection. Further, each of these response formats can be applied to memory quantity or memory accuracy, which is exactly what Koriat and Goldsmith (1994) did in their study. The results showed that test format, but not report option, affected quantity performance. By contrast, report option, but not test format, affected accuracy performance. With these experiments, Koriat and Goldsmith (1994, 1996a, 1996b) demonstrated that it is possible to study both accuracy- and quantity-oriented approaches to memory in the same study.

Accuracy-Informativeness trade-off. The role of the rememberer plays a critical role in everyday memory situations in which the accuracy of memory must strike a balance with its informativeness (e.g., Yaniv & Foster, 1995). To explain further, a memory response can be accurate (contain the correct answer) but not informative, but by contrast, an informative answer can be inaccurate (not contain the correct answer). For example, if person A asked "how tall is the CN tower?" and person B replied "somewhere between one foot and two million feet" it is unlikely to give person A an idea of roughly how tall the CN tower is, despite the presence of the true value being included in the answer (1814 feet). In contrast, if person B's response was "somewhere between 1700 and 1800 feet," this answer, although actually not containing the true value, is much more informative as person A could use the estimate to construct a visual image of the CN tower's height. Thus, a key aspect of metamemory involves a balance between the accuracy and informativeness of an individual's response (Yaniv & Foster, 1995). Metamemory enables individuals' to skillfully work *with* memory encoding, storage, and retrieval, rather than metamemory reflecting a *type* of memory (Benjamin & Ross, 2008).

In one of the earliest studies to examine the accuracy-informativeness trade-off, researchers had participants make interval judgments for uncertain quantities, while explicitly emphasizing that participants should make judgments that would contain the true value 98% of the time (Alpert & Raiffa, 1982). From a theoretical perspective, the best strategy would be to provide extremely wide intervals. In this study, Alpert and Raiffa (1982) found that participants provided interval widths that were incorrect 42% of the time, rather than the 2% that was expected. It seems then that in general, people are uncomfortable providing extremely wide intervals when asked to estimate quantities, perhaps because doing so may violate social norms on proper communication. As the above example with the CN tower illustrates, if someone provided the height estimate of one foot to two million feet, the listener could take that as a glib, offensive reply rather than a sincere effort to communicate meaning. Indeed, providing overly coarse answers in a conversation violates Grice's (1975) maxims of quantity and quality, which are implicit, social-pragmatic norms about communication. Violating these norms can have a deleterious effect on conversation, and potentially relationships. Although the accuracy-informativeness trade-off has mostly been studied using estimates of quantities, attempts have been made to study lexical informativeness (e.g., The CN tower is the tallest building in Canada; McAnanama, 2013). As will be argued below, OGM may reflect an awareness that depressed individuals have about their poor memory, and that in order to follow social-pragmatic norms, decide that it is better to be more informative than accurate. Indeed, research has shown that people are willing to accept some error for more informative responses (Yaniv & Foster, 1995).

Grain size. To return to Koriat and Goldsmith's (1996a) distinction between input- (quantity) and output-bound (accuracy) memory approaches, research has shown that only the latter is under strategic control. For example, when individuals are allowed to control their responses (width of their report interval, whether to volunteer or withhold candidate answers), their accuracy is better for both recall and recognition (Koriat & Goldsmith, 1994). Furthermore, individuals can improve their accuracy based on motivational incentives (e.g., monetary reward; see also Spaniol, Schain, & Bowen, 2013). However, an expected inverse relation was also observed such that increases in accuracy were associated with decreases in quantity performance. In this experiment by Koriat and Goldsmith (1994), participants were given either high or moderate incentives for their accuracy, in which the high incentive condition offered some reward for correct responses but the forfeiture of all winnings for incorrect responses while the moderate incentive condition offered equal reward and risk for correct and incorrect answers. The results showed resoundingly that under high incentive conditions, individuals could dramatically increase their accuracy. This is accomplished, in part, by widening the interval of their responses. Collectively, this kind of finding is thought to exemplify the metamemory principle known as *grain size setting*. Grain size is a term used to describe the precision of a candidate answer. Across all studies investigating memory performance and grain size setting, the relation emerges that as accuracy increases, so does grain size. The trade off, of course, is that as grain size increases the informativeness of that answer decreases (e.g., accuracy-informativeness trade-off).

Grain size can also be influenced by the social demands on the situation, as discussed above. In general, people believe that their answers should have some pragmatic value. Thus, when they are uncertain about their answers, they are likely to increase the coarseness of their responses (e.g, Grice, 1975). Coarsening one's responses increases the likelihood of their correctness, but often decreases their informativeness. This is the balance that individuals have to strike in any social situation, or any situation requiring a response from memory. Grain size setting may partially explain the OGM effect in MDD. Indeed, research has shown that people adjust their answers to provide as much information as possible, so long as the probability of being correct is at a reasonable level; this has been referred to as the satisficing model (Goldsmith, Koriat, Weinberg, & Eliezer, 2002). In a series of experiments, Goldsmith and colleagues (2002) experimentally manipulated grain size reporting in a general knowledge test by using two phases that first allowed participants to select between a fine and coarse grain response; in the second phase, participants were allowed to choose which answer they would rather provide as an expert witness testifying before the government. Overall, the results from these experiments supported the satisficing model by demonstrating that grain size choice was not guided only by the desire to be correct or the desire to be informative. Instead, coarse grain responses were favoured only when participants believed they had a subjectively low probability of being correct with the fine-grained response.

In other words, participants made strategic decisions about what grain size to use, weighing levels of accuracy and informativeness. According to the satisficing model, people will use a more coarsely grained answer to maximize their likelihood of being correct. This model was recently further refined to increase its real world validity by adding a minimum informativeness criterion because previous studies indicated that, in knowledge states of uncertainty, when participants were explicitly instructed to provide answers that would be correct with 95% certainty, only 47% of participants' answers were correct (Yaniv & Foster, 1997). That is, participants will not provide extremely coarse answers just for the sake of being accurate (Ackerman & Goldsmith, 2008). The refined model is referred to as the dual-criterion model and it states that respondents strive to provide the most precise answer that passes both a confidence criterion (subjective or objective percent to which the answer is deemed to be correct) and an informativeness criterion (Ackerman & Goldsmith, 2008). The informativeness criterion is the minimum level of precision or maximum level of coarseness deemed to be socially acceptable. To illustrate, imagine a participant is asked to determine how long ago money was invented. If the original satisficing model were true, then participants should provide wildly coarse answers to questions they do not know the answer to, such as "one to one billion years ago." This is not the case, however. Instead, participants will not violate the confidence criterion (provide coarse answers) just to be accurate if it also violates the minimum-informativeness criterion and will respond with the answer "don't know." This is important because in the context of this research the "don't know" response does not mean that the participants do not know anything about the questions they are being asked. Rather, "don't know" means that participants are unwilling to provide answers so broad that they are no longer socially acceptable, because theoretically (according to the satisficing model), participants should never respond with a "don't know" as they could just coarsen their answer to ensure accuracy.

Quantity- and accuracy-oriented approaches in AM. The variables influencing memory performance are important in the context of OGM. First, current AM paradigms are best characterized by the accuracy-based approach of memory rather than the quantitative-based approach as no studies to date have been interested in the number of autobiographical events reported by participants. Instead, researchers have focused on qualitative aspects of accuracy in AM in which different levels of specificity are of interest. For example, “in my twenties” is an overgeneral response, whereas “just after my 25th birthday” is more specific. A confound here is that overgeneral memories are *more likely* to be accurate (contain truth value) because they have more room for error than specific responses (see above for accuracy-informativeness trade off). Unfortunately, obtaining accuracy-based measures of an experienced autobiographical event presents a daunting experimental task that has yet to be done convincingly as the ability of researchers to determine the veracity of real-life events is limited (cf. Rekkas & Constable, 2005). Part of the difficulty associated with measuring AM is the fact that not every event experienced by an individual is incorporated into his or her autobiographical knowledge base (e.g., Conway, 2005). Moreover, researchers are not privy to the full scope of events that an individual experiences. Rather, the vast majority of events are forgotten within a 24-hour time span (Conway, 2005). According to Conway (2005), events must be tied to enduring goals to become integrated into an individual’s autobiographical knowledge base. As a result, laboratory-based tasks are unlikely to be successful at creating AMs and instead be creating and measuring episodic memory which is a related, yet distinct (according to AM theorists) memory system (e.g., Conway, 2005; Fivush, 2010; cf Cabeza et al., in press). This distinction is inherently problematic for the AM literature, because by definition, researchers are not measuring the primary construct and instead measuring recent episodic experiences that are then assumed by the experimenters to be autobiographical in nature. This assumption, however, is invalid. As Fivush (2010) has explained, episodic memory – the ability to recollect the what, where and when of an event – and autonoetic consciousness – the ability to mentally time-travel to a past event and re-experience it as happening to *oneself* – are required for the recollection of an AM.

To further complicate the picture, research on AM cannot, by definition, measure its primary memory property: accuracy. Researchers have relied on retrospective accounts through various methods to determine the 'accuracy' of AM (e.g., Kopelman 1990; Levine, 2001; Williams and Broadbent, 1986). The problem here is that there is no way for researchers to ascertain the veracity of these events, whether episodic or autobiographical (although see Plancher, Tirard, Gyselinch, Nicolas, & Piolino, 2012 for promising attempts). Despite this, depression and AM literature has primarily used these retrospective accounts to measure AM (see King et al., 2010 for a review). At best, this literature has demonstrated that AM in depression is qualitatively different from AM in non-affected individuals; at worst, it has needlessly overcomplicated the literature on memory. For example, it is well known that individuals with depression have poor memory in general (e.g., Bora et al., 2012; McDermott & Ebemier, 2009). This in and of itself may account entirely for the OGM phenomenon. Characterized by broad categories of events or long periods of time, overgeneral memory responses provide the most accurate, but least precise information. Research has shown that when individuals are not confident in their candidate answers, they tend to broaden the quantitative range of their answer to include the correct value, even on basic episodic memory tasks (e.g., Koriat & Goldsmith, 1996a). Thus, low confidence in depression may cause affected individuals to report broad categories of events rather than unique, specific events; similarly, poor memory (as above) in general could account for such findings. Moreover, research has also shown that when participants are instructed to answer questions on something about which they have little knowledge, they are more likely to provide highly uninformative (but accurate) information. In fact, one study showed that as participants' knowledge decreased on a particular subject, they were more likely to increase the numeric range of their responses (Goldsmith, Koriat & Eliezer, 2002). More specifically related to this dissertation is AM and metamemory in the context of depression and depressive symptoms. Below is a review of the clinical and cognitive features associated with major depressive disorder.

Clinical and Cognitive Features of Depression

Major depressive disorder (MDD) is the most common mental health disorder across the lifespan, with as much as 16.6% of the population being affected (Kessler, Berglund, Demler, Jin & Walters, 2005). It is characterized by periods of depressed mood and anhedonia (loss of interest or pleasure in previously enjoyed activities) combined with poor sleep, changes in weight and psychomotor functioning, low energy, feelings of worthlessness and impaired cognition as well as a preoccupation with suicide (American Psychiatric Association, 2000; 2013). In fact, estimates suggest that up to 15% of individuals with MDD die as a result of suicide (American Psychiatric Association, 2000). Importantly, depression as a mood state, and MDD are also associated with significant role impairment (Kessler et al., 2003) and an annual cost of $83 billion dollars in the

United States (Greenberg, Kessler, Birnbaum, Leong, Lowe, Berglund, & Corey-Lisle, 2003) and $51 billion in Canada (Dewa, McDaid, & Ettner, 2007). Although the hallmark feature of MDD is depressed mood, other core components of the disorder include cognitive impairments, especially prominent in the domains of memory and executive function; notably, these impairments are exacerbated when depressive symptom severity is high (McDermott & Ebmeier, 2009). More specifically, individuals with MDD have been shown to have impaired episodic memory (d = .53 for recognition; d = .98 for free recall; e.g., Pauls, Petermann, & Lapach, 2015; Porter, Bourke, & Gallagher, 2007) and visuospatial memory (e.g., d = .66; Elliott, Sahakian, Mckay, Herrod, Robbins, & Paykel, 1996; Pauls et al., 2015; Porter et al., 2007). Consistent with these observations, imaging research shows reduced hippocampal volumes in individuals with MDD (e.g., Bremner, Narayan, Anderson, Staib, Miller, & Charney, 2000; Drevets, Price, & Furey, 2008). With respect to executive functions, individuals with MDD have been found to have impaired attention and working memory compared to healthy control participants (e.g., Trivedi & Greer, 2014). The magnitude of these executive impairments ranges from small in attention (e.g., d =.22) to moderate in verbal fluency (e.g., d = .59) and cognitive flexibility (e.g., d = .53; Trivedi & Greer, 2014). Neuroimaging studies have routinely reported volumetric reductions in MDD in the dorsolateral prefrontal cortex, an anatomical region thought critical for executive function (e.g., Koenigs & Grafman, 2009). Functional connectivity has also been reported to be affected in the dorsolateral prefrontal cortex in individuals with MDD compared to healthy controls, with some studies showing increased connectivity (Shen et al., 2015), while other studies show decreased connectivity (Alexopoulos et al., 2012). More recent work has suggested a generalized moderate deficit in cognitive processes in MDD rather than a series of domain specific impairments (Porter, Robinson, Malhi, & Gallagher, 2015). Overall, individuals with MDD perform roughly half a standard deviation below healthy controls on measures of memory and executive function, while having preserved sensory motor skills, general verbal ability, and visual processing (Reichenberg, 2010). There is some evidence that these alterations in cognitive functioning persist when individuals remit from depressive episodes (Bora, Harrison, Yucel, & Pantelis 2012; Hasselbalch, Knorr, & Kessing, 2011). The longitudinal and directional relations between cognition and MDD, however, are unclear at present, and warrant further research. Taken together, these findings support the notion that cognitive impairments are related broadly to MDD and that they are modulated by symptom severity as well as mood state. In the context of subthreshold depressive symptoms, one might expect a smaller magnitude of cognitive impairments.

In general, the cognitive impairments associated with MDD are important because they may play a role in the maintenance of the disorder (e.g., Beck, 1976) and are related to functional outcomes, including workplace performance (McIntyre et al., 2013). Impairments in memory, attention and executive function further interact with the well-documented cognitive processing biases observed in depression that are especially prominent for emotionally laden material (Christensen & King, 2013). Briefly, increased recollection of negative material and difficulties disengaging from negative material are common in depression. In recent years, researchers have given a fair amount of attention specifically to AM in MDD (Williams et al., 2007). Originally observed in this literature, and routinely reported since its discovery in 1986 by Williams and Broadbent is a phenomenon known as OGM. Although OGM has been reported in other disorders, for example, posttraumatic stress disorder (e.g., Brown et al., 2013), it has not garnered as much attention outside of depression and MDD. OGM is the tendency to report categories of events rather than specific instances of one event, tied uniquely to time and place (for a review, see King et al., 2010).

One method that has been used to test the OGM phenomenon is the Autobiographical Memory Test (AMT; Robinson, 1976) that provides participants with a cue word to which they are asked to report one specific related memory. For example, in response to the cue word "scared," individuals with MDD are likely to report repeated instances of events (e.g., "every time I leave the house") or long periods of time (e.g., "the winter time") rather than unique events or unique instances of a repeated event (e.g., "my second time on a roller coaster"). Importantly, healthy controls are more likely to recall events that are specific to time and place; hence, individuals with MDD have "overgeneral" memories in comparison. One of the reasons this finding has garnered so much interest is that it has been found to have unique predictive value in determining the course and severity of present and future depressive episodes that has not been observed in other disorders (e.g., Brittlebank, Scott, Williams, & Ferrier, 1993; Dalgleish, Spinks, Yiend, & Kuyken, 2001; see Sumner, Griffith, & Mineka, 2010 for a meta-analysis). Specifically, studies have found that OGM is predictive of longer and more severe depressive episodes, and has been shown to predict the onset of new episodes (Kleim & Ehlers, 2008); these studies, however, did not examine the contribution of poor episodic memory to the severity, or likelihood of future depressive episodes.

It has also been proposed that OGM serves to minimize negative affect in depression by preventing detailed recollections of past events (Williams, 1996). Experimental evidence has indeed shown that when recalling specific negative events, individuals with MDD report experiencing more distress than individuals who recall OGMs (Raes, Hermans, de Decker, Eelen, & Williams, 2003). Thus, there may be some adaptive value, at least initially, of OGM. In the long term, however, there are likely negative consequences. Specifically, in the context of Beck's (1976) cognitive model of depression, OGM may strengthen longstanding negative schemas about the self, others, and the world by preventing specific instances of schema-incongruent evidence from being carefully evaluated. Schemas that remain unchallenged by contradictory evidence are likely to persist and continue to influence how individuals with MDD view the world and their role in it. Importantly, schema change is a critical component to Beck's (1976) cognitive (behavioural) therapy, and many of the activities in therapy, such as thought records, actively challenge schemas and are thought to promote recovery from depression. Other forms of therapy, such as schema-focused therapy, also place an emphasis on changing long-held maladaptive schemas through various therapeutic techniques (Young, Klosko, & Weishaar, 2003). Largely, forcing the recollection of specific instances that disprove previously held beliefs challenges these schemas. Some studies, in fact, have trained AM specificity and have found that depressive symptoms remit (e.g., Neshat-Doost et al., 2013; Raes, Williams, & Hermans, 2009).

Another model of OGM. To date, only two models have been proposed in an attempt to explain OGM: Conway and Pleydell-Pearce's (2000) SMS (described in detail above), and Williams et al.'s (2007) Capture and Rumination, Functional Avoidance, and

Impaired Executive Function (CaR-FA-X) model. Briefly, in the SMS, OGM is thought to result from an early termination of the search process in which depressed individuals do not search beyond "general events." One potential reason for this halted search process is to avoid the negative affect associated with a variety of emotional experiences; thus, OGM may serve the function of reducing the amount of distress an individual experiences. From a learning perspective, this strategic decision to terminate the memory search process early serves as a type of functional avoidance that is negatively reinforced when the individual does not experience additional negative affect. This line of thinking, however, seems more consistent with avoidance in PTSD, which is one of the hallmark symptoms of the disorder (American Psychiatric Association, 2013).

In Williams et al. (2007) CaR-FA-X model, functional avoidance plays a critical role in the maintenance of OGM just as it does in the SMS, but the CaR-FA-X model also proposes that other variables contribute to OGM. In the first stage of this model is the *capture* and *rumination* that may interfere with the retrieval process. Capture refers to an individual's idiosyncratic tendencies when processing information. According to Williams et al. (2007) and other memory theorists (e.g., Conway & Pleydell-Pearce, 2000; Johnson, 1992) the early stages of retrieval use conceptual processing, which are self-representations including personal semantic information, and self attributes (Conway, Singer, & Tagini, 2004). In other words, the early stages of memory retrieval rely on characteristic ways of processing information, or schemas. If this is the case, then Williams et al. (2007) suggest that the preponderance of self-referential conceptual processing might interfere with the retrieval in two groups: those who have elaborate emotional schemas and those who engage in excessive rumination. Individuals diagnosed with MDD are likely to fall into both of these categories. Further, some research indicates that sub-clinically depressed individuals also fall into these categories (Ramponi, Barnard, & Nimmo-Smith, 2004; Roberts & Carlos, 2006; Williams et al., 2007). Throughout the act of retrieval, in the CaR-FA-X model, depressed individuals may get "captured" at this stage and have difficultly retrieving specific memories because of their inability to quell longstanding negatively held schemas. For example, when asked to recollect a story of successfully coping with stressors, individuals with MDD are likely to be inundated with mood-congruent events/themes of failures to cope, and have difficulty persevering through to a successful memory search. Here, the to-be-retrieved memory may have to compete with active, yet unrelated schemas that ultimately reduce the amount of available cognitive resources. Once the depressed individual begins to wade through task-irrelevant schemas, the emotional valence of the schemas may then capture and sustain attention, preventing the retrieval of a specific memory (Williams et al., 2007). Indeed, depressed individuals have difficulty disengaging from negative material (see Christensen & King, 2013 for a review).

Rumination may also contribute to the maintenance of OGM, as Watkins and Teasdale (2001) showed in an experiment with depressed individuals. This experiment manipulated participants' focus of attention (high or low self-focus) and thinking style (high or low analytical thinking) as a 2x2 design. To illustrate, the high self-focus/high analytical thinking condition required that participants reflect upon what their feelings might mean, whereas the high-self-focus/low analytical thinking condition required that participants focus on any physiological sensations. In the low self-focus/high analytical thinking condition, participants were asked to think about understanding the world we live in, whereas the low self-focus/low analytical thinking condition required that participants think about external objects such as an umbrella. In this study, participants were asked to recall AMs after being induced to process information in each of the abovementioned ways. The results showed that abstract thinking styles reduced memory specificity regardless of ruminative state, whereas self-focus (e.g., rumination) was related to negative mood. Taken together, the CaR-FA-X model proposes two avenues that may alter the retrieval process in depression.

Next in the CaR-FA-X model is the notion that depressed individuals have impaired executive functions (e.g., Bora et al., 2012; McDermott & Ebemeier, 2009). Implicit in this component of the model is that individuals have limited cognitive resources, and that cognitive resources are required for effortful tasks. The retrieval of AMs is inherently a demanding task, which requires working memory to hold the query in mind, an open-ended generative retrieval of relevant information, and the suppression of irrelevant information (Conway & Pleydell-Pearce, 2000). While this effortful cognitive process is underway, it is likely that depressed individuals are also dealing with the allure of emotionally valenced material, which naturally directs their attention away from the current task, decreasing the remaining resources. At this point, an interaction occurs between the capture and rumination components, and the reduced executive function component of this model.

Taken together, the CaR-FA-X model proposes that OGM is the result of interplay between affective experience (functional avoidance), altered cognitive operations (capture, rumination), and impaired executive functions. In the context of MDD, these three domains are widely known to be affected, and when taken together, offer a cogent and parsimonious account of OGM. Inherent in the CaR-FA-X model are several strategic decisions and regulatory processes, many of which can be captured under formal models of metamemory (e.g., Goldsmith & Koriat, 2008).

Integration and Summary of Metamemory and Overgeneral Memory

In the context of depression, it may be the case that OGM is the result of low knowledge or low confidence in candidate answers. In this vein, metamemory research can be utilized to provide significant insight. With respect to OGM in MDD, the literature reveals two critical findings: AM is characterized by impoverished episodic details in depression (e.g., Söderlund et al., 2014), and memories are reported as broad categories of events (e.g., Williams & Broadbent, 1986). As will be explored below, it is plausible that impoverished episodic details leads to the recall of broad categories of events via grain size regulation. Upon closer inspection, the impoverished episodic details may be a reflection of the well-documented neuropsychological deficits in depression while the reporting of broad categories of events may be a metamemory grain size setting issue that attempts to maximize accuracy while preserving minimum standards of informativeness (Ackerman & Goldsmith, 2008; Koriat & Goldsmith, 1996; Yaniv, & Foster, 1995). Grain size is often operationalized as a range for some quantitative value, but there is some evidence linguistic qualifiers can also be used (Weber & Brewer, 2008). Quantitatively, coarse grain answers provide a larger range than fine grain answers; similarly, qualitatively the linguistic coarse grain answers are less constrained than fine grain answers. Importantly, coarse grain answers are more likely to be accurate (contain the true value) but tend to be less informative (useful). At the heart of any memory task, whether it be in the laboratory or in real-life, individuals engage in the strategic regulation of what information to report or withhold and are tasked with providing answers that are expected to be both accurate and informative (Yaniv & Foster, 1997). Yaniv and Foster (1995) showed that when people are the recipients of information, they tend to prefer inaccurate but precise (e.g., fine grain) estimates over accurate but uninformative estimates (e.g., coarse grain). Other variables can add to the modulation of a response as well, such as the demand characteristics, in which an individual would provide more fine-grained answers when providing directions to their house for a friend, as compared to the situation where they were explaining their approximate location to a stranger. OGM may be an attempt in individuals with MDD to similarly maximize both the accuracy and informativeness of their response based on their impoverished memory. Individuals with depression may feel pressure to conform to these norms more so than non-depressed individuals, as indicated by their general risk aversion (Smoski, Lynch, Rosenthal, Cheavens, Chapman, & Krishnan, 2008). One aspect of OGM that is rarely discussed is its accuracy. Given that responses are often categories of events, individuals with depression potentially could be *more* accurate with their memories than healthy controls and this may be the result of setting their report criteria more conservatively (Dougal & Rotello, 2007). At present, this possibility is unknown and is the primary research objective of this dissertation.

Conclusion of Chapter 1

The above sections serve to illustrate that effective memory use requires skill and strategy rather than simply searching a repository of information. Memory performance relies on the integration of various processes, including the search, retrieval, and output decisions (e.g., grain size) that are governed by higher-order strategic processes that affect and are affected by the demands of the situation, the format of the questions, and the expectations of the rememberer (Goldsmith & Koriat, 2008). It is possible that depression-related OGM is not a deficient "type" of memory in depression (e.g., Burnside, Startup, Byatt, Rollinson, & Hill, 2004; Kuyken & Howell, 2000), but rather, an attempt by depressed individuals to perform optimally in the face of their well-documented poor memory, executive function, and reduced processing speed (e.g., McDermott & Ebmeier, 2009). That is, OGM may be a result of depressed individuals recognizing that their memory is not good, and strategically searching, retrieving, and outputting coarse-grained responses about their lives in order to maximize the chances that they are accurate while remaining sufficiently informative. The goal of this dissertation is to examine whether this assertion is plausible, or whether OGM is indeed a standalone phenomenon. As such, three studies were conducted to examine these metamnemonic explanations of OGM in the context of depressed mood. In Study 1 (presented in Chapter 2), participants were tested using Goldsmith and Koriat's (2008) QAP methodology to determine whether deficits exist at the level of monitoring or control in dysphoric individuals. Next, Study 2 (presented in Chapter 3) aimed to examine whether a delay manipulation could "create" OGM, and impoverish episodic memories in dysphoric individuals, with the rationale being that OGM may just be a reflection of poor memory. Finally, Study 3 (presented in Chapter 4) also recruited dysphoric individuals and examined the contribution of working memory, and memory search strategies to autobiographically relevant information, with the underlying rationale being that if individuals are disorganized during the first part of memory performance (e.g., search), it should influence the quality/quantity of their output. For each study, a short introduction is provided to orient the reader towards the relevant goals, and a short conclusion is provided after the results to serve as a “take home” message. In Chapter 5, the data from all the studies are integrated into a single and comprehensive discussion and are compared to existing literature on metamemory, depression, and OGM.

CHAPTER 2: The Quantity-Accuracy Profile (QAP) for Dysphoric and Non-Dysphoric Individuals

Background and Hypotheses

Individuals with depression perform worse on a variety of memory tasks when compared to non-depressed individuals (McDermott & Ebmeier, 2009). Overall, depressed individuals perform approximately half a standard deviation below healthy samples on such measures (Reichenberg, 2010) and these deficits are present even when depressive symptoms remit (Bora et al., 2012; Hasselbalch et al., 2011). With regard to the types of memory deficits depressed people experience, research has shown impaired performance on episodic (McDermott & Ebmeier, 2009) and autobiographical memory (AM) tasks (King et al., 2010; Sumner et al., 2010), for both recall and recognition and across visual and verbal domains. One of the most commonly reported findings in the AM literature in MDD is a pattern of overgeneral memory (OGM), in which memories are reported as either broad categories of events, or repeated instances (e.g., Williams & Boradbent, 1986). Similarly, memory for emotionally laden stimuli has been shown to be impaired in depression (Burt, Zembar, & Niederehe, 1995). However, at present, it is unclear whether these observed impairments represent a generalized or ubiquitous memory deficit, or whether there may be stages of memory processing (e.g., retrieval, monitoring, control, and performance) or particular memory operations that are differentially impacted by a depressed mood. As outlined below, metamemory may represent a set of memory operations that are disproportionately affected by depression.

Research has demonstrated that memory is under our strategic control (Koriat & Goldsmith, 1994; 1996a). Broadly speaking, the processes that interact with memory to strategically regulate encoding, retrieval and reporting are categorized as metamemory (Benjamin, 2008), and a large literature confirms that poor memorial strategy (or poor metamemory), independent of "basic" memorial operations, results in poor memory performance (e.g., Benjamin, 2006; Nelson, Dunlosky, Graf, & Narens, 1994; Young, 2004). The present experiment was designed to examine metamemory processes (specifically, the strategic control of memory output) in dysphoric individuals to determine whether grain size regulation underpins the well-documented memory impairments in this population (McDermott & Ebemeir, 2009). Critically, the assumption here is that memory is not just a storehouse of information, but rather, requires higher-level decision-making processes for its effective use. Following Goldsmith and Koriat (2008), the framework utilized in this experiment was the QAP. In this model, the unfolding of a given memory report is divided into four sequential processes: retrieval, monitoring, control, and performance. Upon being presented with a question, individuals begin the retrieval process by searching for a candidate memory trace. Monitoring is responsible for assessing the accuracy of the candidate memory trace and serves to distinguish it from incorrect traces. Based on the assessed accuracy, the control processes determine whether to output the response and how precise or coarse the response should be (i.e., grain size). Important for the control process is the report criterion, which informs a decision based on whether the assessed accuracy of the retrieved content is high enough (i.e., above an accuracy threshold) to output an answer given the current set of demands at hand (Goldsmith & Koriat, 2008). Also, memory traces that scores below the report criterion value are output as coarser grain levels. Coarse grain responses are also provided when precision is *less* important than accuracy. For example, a precise response may be inaccurate ("world war II ended June 9th, 1945"), so it may be more advantageous to provide a coarse-grain, but accurate response ("sometime in 1945"). Fine-grain responses, however, are provided when both accuracy and informativeness are necessary ("September, 1945"). Generally speaking, fine-grain responses are output with less confidence (Koriat & Goldsmith, 1994, 1996a). As a result, respondents are constantly engaged in a balancing act between the degree of accuracy and informativeness of their answers. Importantly, these two components of memory are at odds with one another. To date, research within this framework has focused primarily on healthy individuals (cf. McAnanama, 2013). The present study, however, used the above framework to test whether dysphoric individuals balance this accuracy-informativeness trade-off in the same manner as non-dysphoric comparison participants when regulating memory output.

Difficulties with grain size setting in depression may emerge for a number of reasons. First, as illustrated above, the well-documented neuropsychological impairment (e.g., McDermott & Ebmeier, 2009) may in and of itself account for such a phenomenon. Or, perhaps individuals with depression have a heightened sensitivity to social expectation and as a result, feel extra pressure to provide accurate, rather than informative accounts of events (Yaniv & Foster, 1995). In this case, the fear of failure may motivate depressed individuals to report information in an unduly large granularity. It makes sense that if memory is impaired in general, and a critical aspect of social interaction is to be informative, then it is in one's best interest to set a wider net, so to speak, when reporting information from memory. OGM then, may be an attempt to mitigate the impact of poor event memory.

The QAP involves a two-phase forced-free report option. Generally, research with the QAP has used quantitative information because it maps most directly onto the notion of fine and coarse grain answers. In Phase 1 of testing, the forced-precise phase, participants provide precise answers even if they are guessing. In Phase 2, participants are allowed to select a fine or coarse grain response while the penalty for inaccurate/uninformative answers is manipulated with either a high ($5) or low ($0.50) penalty for incorrect answers; correct precise answers were always awarded $0.50, whereas correct interval answers were awarded a prorated amount based on the size of the response interval. Common to both phases, participants rated their confidence for each of their responses. These methods generate several useful indices reflecting various aspects of retrieval, monitoring and control processes (see Table 1). The two-phase forced/free paradigm is used because the first phase, (forced-report) provides information about memory retention or retrieval, which is reasonably free of the metacognitive aspects of free reporting (e.g., control). That is, participants do not have the opportunity to make decisions about whether or not to output information, or how large of an interval they should provide. Rather forced-report provides the best estimate of how much an individual has retained or is able to retrieve. In the extremely unlikely event that a participant correctly recalls all the information in the forced-report phase, then their performance in the free recall phase would likely also be perfect. By contrast, perfect performance in the free-report phase does not necessarily guarantee perfect performance in the preceding forced-report phase. Also in the forced-report phase, calibration can be examined, which is the difference between the mean assessed probability of correct answers (i.e., confidence) and the proportion correct of each confidence category used (e.g., 1-10, 11-20…91-100). Similarly, resolution, which is the ability to differentiate correct from incorrect responses at varying levels of confidence, can be examined in the forced-report phase. The free-report phase, by contrast provides crucial information about memory control including sensitivity, and the criteria the participant uses in determining their response criterion (P_{RC}).

To date, no one has utilized this framework to test metamemory processes in dysphoric individuals. By applying this framework and this particular methodology, the current study aimed to explore retrieval, monitoring, control and performance aspects of metamemory in this population. In line with the QAP framework, this study was expected to replicate previous studies (Koriat & Goldsmith, 1996b; McAnanama, 2013) showing that in Phase 1, both accuracy and confidence would be lower than in Phase 2. In Phase 2, when the confidence for a given response does not meet the report criterion, a coarse-grain response would be provided. Finally, in the high penalty condition, participants would increase the amount of coarse-grain responding owing to the higher response criterion set that would be associated with avoiding the large penalty. In other words, when participants are faced with the prospect of losing $5 for an incorrect response, they will strategically provide a more coarse grain response in hopes of “capturing” the correct answer in their interval response. I hypothesized that both groups would exhibit a pattern of increasing accuracy and confidence as grain size increased. Based on previous metacognitive and AM research, I hypothesized that non-dysphoric individuals would be more accurate and would accrue greater rewards (money) through the use of more effective strategies in balancing the accuracy-informativeness trade-off. In other words, I expected that dysphoric individuals would set wider intervals than non-dysphoric individuals (i.e., reflective of OGM). Furthermore, across phases, I expected that both groups would exhibit improvements in their monitoring performance, but that this would be especially prominent in the non-dysphoric group. With respect to confidence judgments, I hypothesized that dysphoric individuals would be under-confident in their responses and thus demonstrate poorer control sensitivity. In other words, dysphoric individuals will be less adept at using their perceived accuracy (monitoring) in determining whether to volunteer precise or coarse responses compared to the non-dysphoric comparison participants.

Method

Participants

Participants were recruited from a first year Psychology course at Ryerson University, via the Sona system. Exclusion criteria included a self-reported history of a neurological condition, a loss of consciousness for more than 30 minutes, a learning disability, all of which were assessed through a brief interview. All participants were between 18 and 55 years of age (see Table 2 for demographics), and identified English as their primary language, or that they learned English before 5 years of age. Notably, the age range here may seem large, but only one participant was over the age of 22. For this experiment, the 21-item version of the Depression, Anxiety and Stress Scale was used (DASS-21; Antony, Bieling, Cox, Enns, & Swinson, 1998) to prescreen for participant selection: participants eligible for this study had to have completed the Prescreen Questionnaire available through the Sona system to determine group membership.

Participants who completed the prescreen with a DASS-21 depression score of less than 10 were able to enroll in one arm of the study (non-dysphoric), whereas participants with a score of 10 or greater were able to enroll in the other arm (dysphoric). Importantly, there were no differences between the two arms with respect to demographic variables. Rather, the prescreen was used in order to get a more equal distribution between the groups. When participants arrived for the actual experiment, they completed the DASS-21 again to obtain their current levels of depression. A total of 89 participants enrolled in this study. Eleven participants did not complete the three phases of the experiment due to time constraints; their data were excluded from the analyses. An additional two participants' data were excluded due to procedural errors (e.g., incomplete or missing confidence ratings). Thus, the final sample size was 76 participants, 40 of whom were non-dysphoric, and 36 of whom were dysphoric.

There were significantly more females than males in the sample $\chi^2(1, N = 76) = 47.37$, $p < .001$, but the groups did not differ in their sex distribution, *ps* > .05. There was no difference between groups on age. Full-scale IQ scores were estimated using the Matrix Reasoning and Information subscales of the Wechsler Adult Intelligence Scale-III (WAIS-III) using deviation quotients as per Sattler and Ryan (2009). The groups differed significantly on Matrix Reasoning scores, with the non-dysphoric group performing better than the dysphoric group, $t(74) = 2.14$, $p < .05$; there were no group differences on the Information subscale or FSIQ. Importantly, the differences in Matrix scores between groups is of statistical, but not clinical or meaningful significance as both groups scored in the "average" range for both tests.

To measure the clinical characteristics, we used the DASS-21, and all participants completed a 58-item measure of personality and psychopathology derived from portions of the Personality Assessment Inventory (PAI; Morey, 1990), as used in previous studies from our lab (e.g., Christensen, Girard, Benjamin, & Vidailhet, 2006). Items included those from the PAS (Personality Assessment Screener; Morey, 1991) and the NIM (Negative Impression Management), PIM (Positive Impression Management), ALC (Alcohol Use), and DRG (Drug Use) subscales from the PAI. Due to clerical errors, and incomplete forms ($n = 4$), or participants declining to answer the questionnaire ($n = 3$), data for the PAI are only available for 69 of the 76 participants. Significant differences were observed for clinical characteristics: the dysphoric group had higher scores on the total DASS-21 scores, $t(74) = 8.13$, $p < .001$, as well as on all the subscales, depression $t(74) = 12.96$, $p < .001$, anxiety $t(74) = 3.80$, $p < .001$, and stress, $t(74) = 4.27$, $p < .001$. The dysphoric group scored in the moderate range of severity across each subscale of the DASS-21, whereas the non-dysphoric group scored in the normal range across each subscale. The distribution of scores on the DASS-21 formed a bimodal distribution, which is in line with our expectation. For scores on the depression subscale, the non-dysphoric group scored in the range of zero to eight (normal), whereas the dysphoric group scored in the range of 10 to 38 (mild 10-13; moderate 14-20; severe 21-27 and extremely severe 28+). As reviewed by Williams et al. (2007), previous studies on dysphoria have used the same cutoff scores in determining group membership. Ranges on the anxiety subscale were from zero to 22 for the non-dysphoric group, and from zero to 32 for the dysphoric group. Ranges for the stress subscale were from zero to 34 in the non-dysphoric group and between zero and 36 in the dysphoric group. Similarly, the dysphoric group scored significantly higher on total PAS, $t(67) = 3.12$, $p < .01$; DRG, $t(67) = 2.05$, $p < .05$, and NIM scales, $t(67) = 3.64$, $p = .001$. The dysphoric group scored in the mild range across these subscales, while the non-dysphoric group scored in the normal range. The non-dysphoric group scored significantly higher on the PIM scale, $t(67) = 3.14$, $p < .01$, but both groups scored in the same qualitative range (normal). No differences were observed on the ALC subscale; both groups scored in the normal range (see Table 2). No participants scored above the cutoff scores for the PIM or NIM suggestive of responding in a manner that might be invalid; that is, all participants responded in a forthright manner. Given the target population in the study and documented evidence for high-rates of psychopathological symptoms that are comorbid with dysphoria (e.g., Williams et al. 2007), the above differences on the PAI scales are unsurprising.

Procedure

Ryerson University's Research Ethics Board approved the experiment and voluntary, written consent was obtained from each participant (see Appendix 1). Participants were tested individually in the Brain Imaging and Memory laboratory, in a one-hour session that gave them 1% credit towards their Psychology 102/202 grade. This experiment also contained an added monetary incentive tied to the participant's performance. Each participant was told this upon arriving at the laboratory, and not advertised on the Sona system, so as not to bias the sample beforehand. The maximum monetary reward that participants could be awarded was $15.

Experimental Measures

The test materials and procedure followed those developed by McAnanama (2013) for use with Canadian clinical (schizophrenia) and healthy samples. Participants read aloud a short, 2575-word fictitious story of a police transcript with a number of quantitative targets (e.g., time) accompanied by an appropriate lexical descriptor (e.g., 7:05 A.M., after sunrise). Using the Flesch-Kincaid Reading Ease formula for readability (Flesch, 1948; Kincaid, Fishburne, Rogers, & Chissom, 1975; see Appendix 2), the document scored 80.8/100, indicating an easy level of readability. Pooling across several measures of grade-level, the document scored an average grade level of 5.8, indicating that an average individual with a fifth grade education would be able to understand the document. The test consisted of questions related to the transcript; testing was conducted in three phases. Each phase began with a short practice test to ensure that participants understood the instructions. In each phase, participants rated how confident they were in each of their answers based on the story from 0% to 100%. Importantly, each phase asked *the same* questions. Phase 1 required participants to provide precise responses even if they had to guess (e.g., Phil arrived at the club at _______). All questions were asked in Phase 1 before starting Phase 2. In Phase 2, participants were allowed to answer questions using either precise responses (e.g., "he arrived at 22:44") or interval responses (e.g., "he arrived between 22:40 and 23:00"). Correct precise responses were always awarded 50 cents, whereas correct interval responses were prorated for their size, such that larger intervals were awarded less (e.g., 10 cents for "he arrived between 22:30 to 23:00"), and smaller intervals were awarded up to 40 cents (e.g., "he arrived between 22:40 to 22:45"). Incorrect answers, however, carried either a high penalty ($5) or low penalty (50 cents). The test was designed so that half the items were high penalty, and the other half were low penalty; two test forms existed to ensure that all items (across the sample) had the chance to be high or low penalty, in order to ensure that the difficult (or easy) questions were not disproportionately high or low penalty. Item order was not randomized; instead, the test was structured to follow the order of events from the story. As in McAnanama (2013), intervals that were too wide to be informative were considered incorrect (e.g., Phil arrived between 12:00am and 5:00am; for further details see Appendix 3). Pilot testing had previously been conducted to determine reasonable interval widths for coarse-grain responses. Each item had its corresponding penalty listed beside the corresponding question. Participants were informed that they did not have to pay their losses if their penalties exceed their total bonuses (which was often the case). Once again, all questions in phase 2 were asked before proceeding to phase 3. Finally, in phase 3 participants were asked to respond with meaningful lexical responses or descriptions (e.g., Phil arrived at the club at quarter to eleven) rather than quantitative values and then rate their responses using the same 0-100% confidence scale. The lexical responses gathered from phase 3 were scored in accordance with previous work (McAnanama, 2013). Briefly, lexical responses were considered accurate based on predetermined ratings by a set of independent judges. Correct answers, then, fell within the agreed-upon range. Participants were informed that if they provide the correct descriptor to an item for which they previously were penalized, the penalty would be removed, which would increase their chances of earning a monetary bonus. For example, if in Phase 2 a participant incorrectly stated that Phil arrived at 22:40 and was penalized

$5, and then in phase 3 accurately stated that he arrived “around quarter to 11” the penalty from Phase 2 would be lifted.

Data Analysis. Before data analysis, all data were checked for entry errors, missing values, outliers, and examined for violations in parametric assumptions. Participants with missing values were excluded from analyses (those that did not finish all three phases, above). All analyses were completed using SPSS version 21. Alpha was set to .05, unless stated otherwise. If there was a violation of sphericity, I applied the Hyun-Feldt corrected degrees of freedom.

Calibration error scores were calculated following the guidelines provided by Oskamp (1962).

1) Calibration error = $(\Sigma\ n_i\ |d_i|)/N$

where: i is any point on the confidence scale,

$|d_i|$ is the absolute deviation at that point,

n_i is the number of judgments at that point, and

N is the total number of judgments made.

Resolution (also known as discrimination) is the ability to differentiate correct from incorrect responses at varying levels of confidence. We calculated resolution using the formula for the Adjusted Normalized Discrimination Index (ANDI) provided by Yaniv, Yates, & Smith (1991):

2) ANDI = $((N * NDI) - J + 1) / ((N – J) +1)$

where: N is the number of observations,

NDI is the Normalized Discrimination Index, and

J is the number of judgment categories.

Results

Phase Manipulation: Accuracy and Confidence

As per previous QAP experiments (e.g., Koriat and Goldsmith, 1996a), it was anticipated that both accuracy and confidence would increase across phases in conjunction with increasing grain size. In order to examine this, a 2 (Group) × 3 (Phase) repeated measures ANOVA with accuracy as the DV was conducted. The results show that accuracy increased across phases, $F(1.53, 113.26) = 185.42$, $p < .001$, $\eta_p^2 = .72$ (Phase 1 accuracy = .47, Phase 2 accuracy = .52, Phase 3 accuracy = .70). Follow up pairwise comparisons indicated that participants performed better in Phase 2 than in Phase 1, $t\,(85) = 6.68$, $p < .001$. Similarly, participants performed better in Phase 3 than in Phase 2, $t\,(85) = 4.89$, $p < .001$. However, the main effect of Group was not significant ($F = 1.44$, $p = .24$, $\eta_p^2 = .02$), contrary to expectations.

Similarly, a repeated measures ANOVA revealed that confidence also increased across phases $F(1.84, 136.17) = 74.65$, $p < .001$, $\eta_p^2 = .50$ (Phase 1 confidence = 62.37, Phase 2 confidence = 70.07, phase 3 confidence = 77.60). The main effect of Group was again not significant $F\,(1, 74) = .05$, $p > .05$, $\eta_p^2 = .001$), failing to support the hypothesis that non-dysphoric participants would be more confident than dysphoric participants. Thus, the phase manipulation for this study worked in that both accuracy and confidence increased across the three phases. However, no group differences were significant, suggesting both groups benefitted equally as grain size increased.

Incentive Manipulation: Effect on Output

In order to investigate the effect of incentive on output a 2 (Group) × 2 (Penalty) repeated measures ANOVA was conducted with amount earned as the DV, and it revealed a main effect of penalty schedule $F(1, 74) = 58.04$, $p < .001$, $\eta_p^2 = .44$, such that both groups lost more money in the high penalty condition than in the low-penalty condition (high penalty loss = \$19.29, low penalty loss = \$0.71). There was no main effect of Group $F(1, 74) = 1.40$, $p > .05$, $\eta_p^2 = .02$), and there was no interaction between Group and Penalty Schedule F (1, 74) = .46, $p > .05$, $\eta_p^2 = .006$. That is, there was no significant difference between groups on high $t(74) = -0.88$, $p > .05$ and low $t(74) = -0.98$, $p > .05$ penalty items. On high penalty items the dysphoric group "lost" an average of \$17.33, whereas the non-dysphoric group "lost" an average of \$20.97. On low penalty items, the dysphoric group "lost" \$0.23, while the non-dysphoric group "lost" \$1.27. Participants did not have to pay even when they "lost money;" rather, they did not receive a reward.

To quantify grain size, another measure of output, I followed previously published guidelines (Yaniv & Foster, 1995, 1997) that require the computation of a logarithmic function of the interval size for coarse grain responses in Phase 2, while precise responses were set as ln(1) = 0. Next, a 2 (Group) × 2 (Penalty Schedule) repeated measures ANOVA was conducted with overall grain size as the DV. The main effect of Penalty Schedule was significant: $F(1, 74) = 6.68$, $p < .05$, $\eta_p^2 = .08$, indicating that participants provided wider response intervals for high penalty items ($M = 1.64$) compared to low penalty items ($M = 1.47$) This is in keeping with previous literature (e.g., Goldsmith, Koriat, & Weinberg-Eliezer, 2002) showing that participants are attempting to balance accuracy and informativeness in a quantitatively different way for high penalty items. Contrary to expectations, however, there was no main effect of Group, F (1, 74) = 1.39, $p > .05$, $\eta_p^2 = .02$, and no interaction between Group and Penalty Schedule, F (1, 74) = .28 $p > .05$, $\eta_p^2 = .004$.

I examined the proportion of meaningful correct answers for interval responses across high and low penalty items by conducting a 2 (Group) × 2 (Penalty Schedule) repeated measures ANOVA with grain size as the proportion of meaningful answers as the DV. There was a main effect of Penalty Schedule, F (1, 74) = 4.70, $p < .05$, $\eta_p^2 = .06$, (meaningful answers for low penalty items = .73, meaningful answers for high penalty items = .80) indicating that participants gave more meaningful answers (e.g., "Phil arrived between 10:30 and 10:55" versus "Phil arrived between 7:00 and midnight") on high penalty than low penalty items. There was no main effect of Group, F (1, 74) = 1.90, $p > .05$, $\eta_p^2 = .03$, and no interaction between Group and Penalty Schedule, F (1, 74) = 0.97, $p > .05$, $\eta_p^2 = .01$.

Memory Monitoring: Calibration and Resolution

Following Lichtenstein, Fischhoff, and Phillips (1982), I calculated calibration by dividing participants' confidence ratings, or assessed accuracy, into 12 categories (0, 1-10, 11-20, 21-30…91-99, 100). In order to create the calibration curves, the proportion of correct answers for a given confidence level was plotted against the confidence ratings. Perfect calibration would be represented by a 45-degree diagonal line (see Figure 2). Under-confidence would be characterized by values above the diagonal line, in which participants' assessed accuracy is lower than their actual correct responses. Over-confidence would be characterized by values below the diagonal line, in which participants' assessed accuracy is higher than their actual correct responses. Figure 2 illustrates calibration curves for each phase. Across all phases, both groups were remarkably similar, and overconfident, but calibration improved across successive phases.

To assess calibration as a function of group and phase, a 2 (Group) × 3 (Phase) repeated measures ANOVA with calibration error scores as the DV was conducted. Here, Mauchly's test indicated that the assumption of sphericity had been violated $\chi^2(2) = 20.44$, $p < .001$, and therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .83$). There was a main effect of Phase, $F(1.66, 122.83) = 8.11$, $p < .01$, $\eta_p^2 = .10$, suggesting that participants improved their calibration across phases. There were no main effects of Group $F(1, 74) = .79$, $p > .05$, $\eta_p^2 = .02$, or any interaction between Phase and Group $F(1.66, 122.83) = 0.87$, $p > .05$, $\eta_p^2 = .01$.

A 2 (Group) × 3 (Phase) repeated measures ANOVA with ANDI as the DV to assess resolution was also conducted. Again, Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 14.95$, $p = .001$, and therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .87$). There was a main effect of Phase, $F(1.75, 129.19) = 28.82$, $p < .001$, $\eta_p^2 = .28$, meaning that resolution worsened as grain size increased. No effects were found for Group $F(1, 74) = 0.77$, $p > .05$, $\eta_p^2 = .01$ and there were no interactions $F(1.75, 129.19) = 1.10$ $p > .05$, $\eta_p^2 = .02$.

Control

Deciding whether to, or how to output an answer constitutes memory control. I calculated Goodman-Kruskal gamma (γ) correlations as an indication of control sensitivity to determine whether confidence scores in Phase 1 were related to the decision to output either precise or coarse responses in Phase 2. The results indicate confidence in Phase 1 indeed correlated with the grain size in Phase 2 for both groups. In the non-dysphoric group, $\gamma = -.36$, $p < .01$, while in the dysphoric group, $\gamma = -.34$, $p < .01$. In both cases, the negative correlation is in keeping with previous literature, where increasing grain size negatively correlates with confidence (Goldsmith et al., 2002). The groups did not differ on their scores in this context.

It was hypothesized that report criterion, P_{RC} values, would be highest for all participants on high-penalty items. To investigate this, a 2 (Group) × 2 (Penalty) repeated measures ANOVA with P_{RC} as the DV was executed. There was a main effect of Penalty $F\ (1, 84) = 6.19$, $p < .05$, $\eta_p^2 = .07$, in which participants had higher P_{RC} values for high-penalty items (i.e., both groups were more conservative; low penalty P_{RC} value = .62, high penalty P_{RC} value = .69). Visual inspection of the data revealed that the dysphoric group set a *lower* P_{RC} value for both high and low penalty items, but this group difference was of small magnitude and failed to reach significance, $F\ (1, 84) = 2.89$, $p = .09$, $\eta_p^2 = .03$ (see Table 3). The interaction was not significant $F\ (1, 57.94) = 0.17$, $p > .05$, $\eta_p^2 < .01$. Generally speaking, both groups exhibited better control sensitivity as penalty increased.

Grain size was calculated following the formula proposed by Yaniv and Foster (1995, 1997) who recommend using the natural logarithm of the response interval plus 1(e.g., ln (30 + 1) for a response width of 30), and precise responses were assigned a grain size of 0. Grain size, separated into coarse-grain and fine-grain responses, was then submitted to a 2 (Group) × 2 (Penalty) repeated measures ANOVA. Here, the main effect of Penalty was significant, F (1, 84) = 8.22, $p < .01$, $\eta_p^2 = .09$, as both groups set wider response intervals for the high penalty items (interval size for low penalty = 1.51, interval size for high penalty = 1.68). There was no main effect of Group F (1, 84) = 0.21, $p > .05$, $\eta_p^2 < .01$, and there was no interaction F (1, 84) = 0.40, $p > .05$, $\eta_p^2 < .01$. When pooling overall grain size, there were no group differences, suggesting that both groups were able to modulate the size of their response interval according to the task demands (e.g., setting a wider interval in response to higher penalty items), F (1, 85) = 0.20, $p > .05$, $\eta_p^2 < .01$.

Discussion

The objective of the present study was to examine the contribution of retrieval, monitoring (calibration and resolution), control and performance aspects of metamemory in dysphoric individuals through the use of Goldsmith and Koriat's (2008) QAP methodology. With OGM as a key motivator for this experiment, this study was designed to address whether dysphoric individuals access, evaluate, and output stored information in similar ways to non-dysphoric individuals. The rationale for implementing the QAP to examine metamnemonic processes stemmed from the findings that individuals with MDD have poor memory in general (Bora et al., 2012; McDermott & Ebemeier, 2009; Porter et al., 2015) and that deficits in AM performance might thus not be particularly extraordinary or unexpected. The QAP allows for a systematic evaluation along the continuum of memory use to determine which aspects of strategic memory processes may be impaired. By examining the key stages of memory use, it promised to provide insight into the potential reasons for OGM.

The data support that retrieval, monitoring, control, and performance aspects of metamemory remain intact in dysphoric individuals. The results from the present experiment show that these "null" findings are not due to poor execution of this methodology. Rather, the manipulation checks and expected main effects turned out as hypothesized, but no group effects or interactions were observed. Together, this suggests that the meta-mnemonic processes examined in this study are generally intact in dysphoric individuals. Specifically, monitoring was examined through both calibration and resolution. As a reminder, calibration is a measure of the degree of correspondence between an individual's subjective assessment of accuracy compared to their true accuracy, and the data from the present study showed that across testing phases all participants improved their calibration scores, which is a normative change in calibration that both groups exhibited equally. That is, as participants were allowed to provide wider response intervals, they became better at matching their assessed accuracy with true accuracy. Resolution, on the other hand, is the ability to differentiate correct from incorrect responses at varying levels of confidence. Across phases all participants exhibited a decrease in resolution as their response interval widened. This means that as participants provided unduly large intervals, they appeared to be aware that their answers were incorrect. Memory control refers to a rememberer's ability to decide how much or whether to report a candidate memory trace as an answer. Control was examined by evaluating how participants set the grain size (e.g., interval width) for their answers under high and low penalty items. Both groups showed that when they had low confidence in their assessed accuracy in Phase 1, their answers were more likely to be coarse (and thus more inclusive) in Phase 2. That is, when participants were forced to choose a precise response to a question for which they did not know the answer, their Phase 2 responses were more likely to be a wide interval. Control was also examined by determining participants' idiosyncratic report criterion, or P_{RC} value. The data showed that both groups tended to be more conservative in the high penalty condition; no group differences were observed statistically, but visual inspection showed that dysphoric participants were more liberal with their responses overall, albeit to a small effect. Lastly, grain size of the coarse responses did not differ between groups, suggesting that they were equally capable of deciding the level of inclusion for their answers. Finally, on measures of overall performance across all phases, the groups did not differ with respect to accuracy, confidence, money earned, or proportion of meaningful answers.

With respect to the original hypotheses driving this study, only hypotheses 2 and 3 were supported. First, it was correctly predicted that grain-size increased positively with penalty. Second, both confidence and accuracy increased as grain-size became coarser (e.g., wider); this suggests that compared to Phase 1 confidence scores for precise responses, Phase 2 interval responses were associated with greater confidence and accuracy. Contrary to hypothesis 1, however, the groups did not differ on the coarseness of their responses; it was predicted that the dysphoric group would have provided coarser responses that would have mimicked OGM. This hypothesis was not supported on three potential outcome measures. Specifically, the dysphoric group did not exhibit underconfidence as reflected in memory calibration whereby I expected dysphoric participants to be less able to match their assessed accuracy (e.g., confidence) with the memory performance. On this outcome measure, both groups performed similarly. Another possibility I proposed was that the dysphoric group would set a more conservative response criterion; here, the groups did not differ statistically but visual inspection showed that the dysphoric group was, if anything, more liberal overall. Finally, the width of participants' response intervals did not differ for either high or low penalty items.

Taken together, these data suggest that in dysphoric individuals the meta-mnemonic processes of retrieval, monitoring, and control are broadly in line with those of non-dysphoric participants. There was no evidence for metamemory impairments in dysphoric individuals. There are several possible reasons for this outcome. First, it is possible that metamemory is spared in individuals with mood related symptoms. This would be good news, as treatments aimed at improving cognitive functioning in depressed individuals could incorporate metamnemonic strategies into their training program. Another possibility is that the sample utilized was not symptomatic enough to have any bona fide impairment in retrieval, monitoring, or memory control. Specifically, the present sample was not administered a structured clinical interview to determine the presence of major depression. Rather, the DASS-21 was used as a measure of symptom severity and group membership was determined via a cutoff method. In this sample, the dysphoric group scored in the moderate range of the DASS-21. Yet another possibility for these findings is that the sample of dysphoric participants is not representative of or generalizable to a clinically depressed sample based on age, education, and IQ. One previous study (Ramponi et al., 2004) found that the differences in AM performance, as measured by the number of categoric responses, between dysphoric and non-dysphoric participants was small in effect size ($d = 0.25$), whereas when using the number of specific responses, the differences was large ($d = .91$). The measure used to assess OGM in the present study differs from that of Ramponi et al. (2004) but the precedent for impaired AM exists in this population. Dickson and Bates (2006) also investigated OGM in dysphoric individuals for both past and future events, and found that dysphoric participants exhibited OGM regardless of temporal direction when compared to non-dysphoric participants. In Dickson and Bates' (2006) sample, the effect size for OGM was medium, $\eta^2 = .65$, using Clark-Carter (2001) converted η^2 Cohen's effect sizes for all events. In a series of experiments, one study showed that dysphoric participants were impaired at generating specific memories on the standard AMT; the authors went one step further and showed that the level of cognitive difficulty correlated negatively with memory specificity, in that participants performed worse on the AMT when they had to perform a digit span task while recalling specific memories (Dalgleish et al., 2007). Finally, one meta-analysis concluded that depressive symptoms, rather than a clear diagnosis of MDD was also associated with OGM (van Vreeswijk & de Wilde, 2004).

Another potential explanation for the null results may be that the current sample of dysphoric participants is quite young (mean age of 18.94). It is possible that the cumulative effects of multiple mood episodes has not yet occurred. Indeed, research has shown that as mood episodes recur, the chance of having another episode increase dramatically (Burcusa & Iacono, 2007), and that number of depressive episodes is associated with the severity of cognitive impairments (e.g., Kessing, 1998). Similarly, younger participants tend to have more specific responses compared to older individuals (Ros, Latorre, & Serrano, 2010), suggesting a potential role for working memory in moderating AM performance, as executive deficits are commonly observed in the elderly (e.g., Kirova, Bays, & Lagalwar, 2015). To date, no studies have examined the difference in AM performance between samples of young versus old depressed participants. In healthy samples, however, research shows a general decline across aging on measures of

AM (e.g., Levine et al., 2002). The lack of group differences in the present study may be attributable to any of the abovementioned reasons, and are clearly some of the limitations. One methodological limitation may have been that the penalty schedule was overly punitive, and a better approach might have been to provide a larger incentive for correct answers rather than punish incorrect answers. This study, however, followed the methodological precedence of other QAP studies (e.g., Koriat & Goldsmith, 1996b; McAnanama, 2013).

One recent study that used the QAP found that relative to a healthy comparison group, individuals diagnosed with schizophrenia were likely to report coarse responses more frequently as their confidence decreased, and more likely to provide responses that were too coarse to be meaningful (McAnanama, 2013). Despite individuals diagnosed with schizophrenia being worse at modulating their responses compared to controls, they still exhibited a fair degree of modulation, suggesting that the skill is not absent. McAnanama (2013) also examined resolution and calibration and found patients and healthy participants were matched on resolution (as in the present study) but that patients were worse at calibrating their confidence to accuracy compared to controls, such that there was a greater mismatch between patient confidence and accuracy. There was also some indication that individuals diagnosed with schizophrenia had worse control sensitivity than healthy controls, as indicated by providing wider interval widths across penalty schedules – in the present study, no differences were detected on this component of the QAP. The results of the present study, however, do not suggest with absolute certainty that metamnemonic processes are spared in mood disorders. It is plausible that with a more acutely depressed sample that deficits may emerge, and it is still a worthwhile research endeavor. Future research should examine this possibility.

Yet another account for the null findings is that the memory deficits observed in individuals with mood related symptoms are specific to AM rather than general episodic memory (e.g., Williams & Broadbent, 1986). This notion is contentious, however, given the clearly documented global cognitive impairments in mood disorders (McDermott & Ebemeier, 2009), and the specific impairments to episodic memory and executive functions (e.g., Reichenberg, 2009). Indeed, presenting challenge to the claim in the literature that memory deficits are specific to AM is the motivating factor in this dissertation. The results of the present study do not clarify what may account for OGM. In the studies that follow, I examine other aspects of memory performance including search strategy and memory organization, as well as some basic memory principles such as forgetting that offer insight into OGM.

Table 1

Summary of Quantity-Accuracy Profile (QAP) Measures

Type	Measure	Description	Phase 1	Phase 2
Memory	Retention	Percentage of forced-report correct answers	X	
Monitoring	Resolution	Gamma correlations between confidence and correctness (ANDI)	X	
	Calibration	Difference between mean confidence and proportion correct	X	
Control	Sensitivity	Gamma correlation between confidence and whether each answer is reported	X	X
	P_{RC}	Estimates of report criterion	X	X
	Effectiveness	Absolute difference between estimated and optimal P_{RC} that would maximize payoff	X	X
Performance	Free-report quantity	Proportion of correct reported answers out of total questions		X
	Free-report accuracy	Proportion of correct volunteered answers out of the number of answers that were volunteered		X

Adapted from Goldsmith and Koriat, (2008) in Benjamin & Ross (2008).

Table 2
Demographic, Cognitive and Clinical Characteristics of the Participants

	Non-dysphoric $n = 40$		Dysphoric $n = 36$	
Demographic Data				
Male/Female	5 / 35		3 / 33	
	M	*SD*	*M*	*SD*
Age	19.08	1.04	18.94	0.71
Cognitive Performance*				
WAIS-III Info	11.60	2.23	11.11	1.67
WAIS-III MR ^{t}	9.88	1.54	9.17	1.32
Clinical Characteristics				
PAI PAS ^{tt}	30.71	21.56	49.58	28.38
PAI ALC	46.63	4.09	49.21	8.38
PAI DRG ^{t}	46.80	6.88	51.29	10.94
PAI PIM ^{tt}	43.77	9.12	36.82	9.27
PAI NIM ^{tt}	47.62	5.38	54.47	9.69
DASS-21 Depression ^{ttt}	4.25	3.11	19.83	6.87
DASS-21 Anxiety ^{ttt}	6.40	5.80	13.42	9.72
DASS-21 Stress ^{ttt}	9.90	7.67	18.89	10.58

* Standard scores

^{t} Significant at .05; ^{tt} Significant at .01; ^{ttt} Significant at .001

WAIS-III (Wechsler Adult Intelligence Scale: Third Edition); MR (Matrix Reasoning); PAI (Personality Assessment Inventory); PAS (Personality Assessment Screener); ALC (Alcohol Use); DRG (Drug Use); PIM (Positive Impression Management); NIM (Negative Impression Management); DASS-21 (Depression, Anxiety, and Stress Scales).

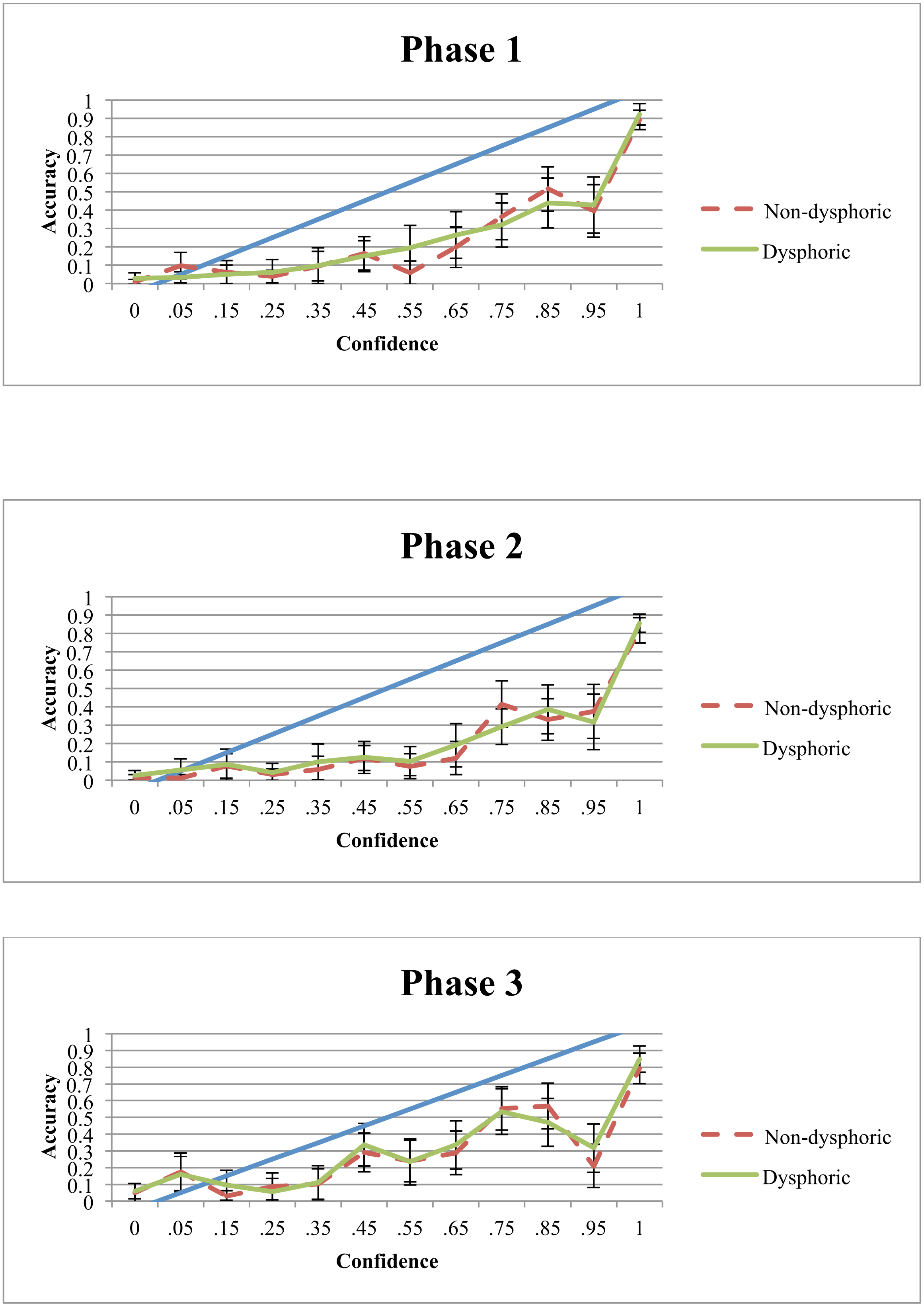

Figure 2. Calibration curves for each phase.

Table 3
Summary of Means (SD) for P_{RC} Values and Grain Size

	Non-dysphoric $n = 40$		Dysphoric $n = 36$	
Penalty Schedule	Low	High	Low	High
P_{RC}	.66 (.29)	.74 (.22)	.58 (.28)	.64 (.28)
Grain Size	1.52 (.81)	1.74 (.89)	1.48 (.79)	1.62 (.82)

No significant differences were observed.

CHAPTER 3: "Creating" Overgeneral Episodic and AM in Dysphoric and Non-Dysphoric Individuals

Background and Hypotheses

Williams and Broadbent (1986) first observed the phenomenon of overgeneral autobiographical memory (OGM) in a sample of patients who had recently attempted suicide. OGMs have since been found to be a reliable correlate of depressive disorders and dysphoric mood (for a review, see Williams et al., 2007) and are generally depicted as having fewer details and lack of specificity to one unique time and spatial location (King et al., 2010). Such a definition begs the question: might OGM simply reflect *poor event memory* in general and not be specific to autobiographical events? It seems reasonable to expect that if various aspects of memory performance are impaired in depression for laboratory-based stimuli, that deficits for real-life events would also be observed. Indeed, meta-analyses have routinely reported memory deficits in depressed individuals (e.g., Bora et al., 2012; McDermott & Ebemeier, 2009), yet no studies to date have attempted to determine whether these impairments are related to OGMs. Conceptualized in another way, OGM may represent a diminishing memory trace over time that could occur at any stage of memory processing (retrieval, monitoring, control, and performance) and manifest in a variety of ways including poor encoding strategies, weak consolidation, or limited attentional resources, prompting oneself with poor memory queries, being less certain about specific details, operating under a more conservative report criterion, or ultimately reporting fewer details. Yet again, the accuracy-informativeness trade off implicit in social interactions (Goldsmith, Koriat, & Weinberg-Eliezer, 2002) may account for OGM in the context of depression, as depressed individuals may try to mitigate the impact of their poor event memory by increasing the grain size. Furthermore, poor memory could also be conceptualized as forgetting. Owing to the overlapping nature of episodic memory and AM, and because AM also contains semantic aspects, the term used throughout this study to refer to all three 'types' of memory will be *event memory*, as it can speak to both episodic memory and AM under one overarching construct without being overly vague or inclusive.

Although forgetting is typically thought of as a nuisance in everyday life, it likely serves an adaptive function that prevents the memory system from overloading (Schacter, 1999). Indeed, remembering every single event that happened to oneself could be highly distressing, as illustrated by the hyperthymestic case of AJ (Parker, Cahill, & McGaugh, 2006). AJ is a normally developing individual, who may have some obsessive-compulsive tendencies, who remembers nearly everything that has ever happened to her, and she reports that she is *unable* to forget events and describes her extraordinary AM as "a burden" because her recollection was "non-stop, uncontrollable and totally exhausting" (Parker et al., 2006, p.35). Interestingly, AJ's memory score on the Wechsler Memory Scale-Revised (WMS-R) is only half a standard deviation above the average. Fortunately, the vast majority of people do not have to bare such a burden, and have the luxury of forgetting. Of course, forgetting is not necessarily an all-or-none phenomenon, as individuals can forget portions of an event, yet vividly recall other aspects of the same event. As Bartlett's (1932) work showed, the reconstructive nature of memory allows for gist based recollections, rather than exact replications of past experiences, which may lend support to the notion of adaptive forgetting. In this line of thinking, forgetting may be the result of having a poor memory trace or a poor memory trace may result in forgetting, both of which could ultimately lead to OGM.

Forgetting is thought to occur via two mechanisms: interference and decay. Generally speaking, it is well understood that memories fade as time passes (Levine et al., 2002), both for laboratory-based stimuli (Brown, 1958; Müller & Pilzecker, 1900; Ebbinghaus, 1913), and AMs (Talarico & Rubin, 2003). A healthy debate began in the early years of the cognitive revolution regarding these two mechanisms of forgetting, and it continues in the present day (e.g., Lewandowsky, Oberauer, & Brown, 2009; Ricker, Vergauwe, & Cowan, 2014). Overall, the interference theory has garnered the most support from researchers (see Brown, 1958; Underwood 1957). The interference theory posits that forgetting occurs because newly acquired material interferes with the retrieval of previously acquired material (also known as retroactive interference), or because previously acquired material interferes with the retrieval of newly acquired material (also known as proactive interference; Postman, 1961). By contrast, Brown (1958) put forth the decay theory of immediate memory, which stated that "when something is perceived, a memory trace is established which decays rapidly during the initial phase of its career" (p. 12). Although both these theories were developed in the context of short-term memory, it stands to reason that it may be able to account for long-term forgetting; however, this issue of short-term and long-term forgetting is highly contentious (Lewandowsky et al., 2009; Ricker et al., 2014). A more contemporary approach is the "new theory of disuse," that offers mechanisms such as retrieval-induced forgetting (e.g., Bjork & Bjork, 1992; Storm, Bjork, & Bjork, 2007). In Bjork and Bjork's (1992) new theory of disuse, a distinction is made between storage strength, which is a measure of how well-learned an item is, and retrieval strength, which is a measure of the immediate accessibility of a given item in memory. In this model, retrieval strength entirely determines whether information is successfully recalled, whereas storage strength does not contribute to recollection. Retrieval capacity is limited as a result of the sheer number of items tied to a memory that competes for retrieval cues, whereas storage capacity is theoretically limitless. Here, the act of retrieving an item from memory serves as a potent learning event that increases that specific item's retrieval strength. Within the retrieval-induced forgetting paradigm, it has been shown that the act of successfully retrieving an item from memory actually causes other information associated with that item to be less accessible moving forward. The argument here is that the retrieval strength of the correctly recalled item is increased whereas all other cues associated with that item had to be inhibited, ultimately weakening the strength (Storm, Bjork, Bjork, & Nestojko, 2006). Although a complete review of forgetting is beyond the scope of the present document, suffice to say that there are several routes to forgetting. Regardless of whether the mechanism of forgetting is decay, interference, or retrieval-induced forgetting, it is one avenue worth exploring in the context of OGM.

Even more recently, it has been proposed that the cause of forgetting, whether interference or decay, depends on the memory representation (Sadeh, Ozubko, Winocur, & Moscovitch, 2016). Specifically, recollection-based memories that are largely supported by the hippocampus were shown to be more resistant to interference than familiarity-based memories. In this study, decay was shown to have a more pronounced effect on recollection-based memories than familiarity-based memories. Memories supported by extrahippocampal structures, namely familiarity-based memories, are more prone to interference. These data support the representation theory of forgetting, which is largely influenced by recent work on pattern separation.

The perceived importance of an event also affects how well an event is remembered. Studies that examine important events tend to examine highly emotional, public events, which has led to the term *flashbulb memory*. Although this study will not investigate flashbulb memories in any way, it is a topic worth exploring in the context of forgetting primarily because flashbulb memories are the clearest example of the effect of perceived importance on memory recollection. Flashbulb memory was originally studied by Brown and Kulik (1977) and defined as "memories for the circumstances in which one first learned of a very surprising and consequential event" (p. 73). In their study, Brown and Kulik (1977) used a questionnaire to ask participants about various public and personal events to determine what types of events, and what factors create flashbulb memories. The data showed that events only became flashbulb memories if they were both surprising and important; events that only contained surprise or importance did not classify as flashbulb memories. Although flashbulb memories have the reputation of being highly accurate, Brown and Kulik (1977) never made that claim, and more contemporary researchers (e.g., Hirst et al., 2009) are usually explicit about the *inaccuracy* of such memories. Not only is the public importance of the event tied to an event's tendency to become a flashbulb memory, but the group or individual importance also appears to be a factor. In this vein, Brown and Kulik (1977) showed that African American individuals better remembered the assassinations of Malcolm X and Martin Luther King than Caucasian American individuals. The authors of this study suggested that the assassinations of these two public figures were of greater significance to African

Americans than to Caucasian Americans, and thus better remembered. In a more recent study on flashbulb memories, Hirst and colleagues (2009) conducted a survey study for the terrorist attack of September 11, 2001 at three time points: one week, 11 months, and 35 months after the attack. They showed that the rate of forgetting for this event was similar to typical flashbulb forgetting within the first year, but that forgetting for this event slowed significantly between year 1 and 3. By the third year, however, the content of the memory remained quite stable. Further, emotional reactions to the event were remembered worse than non-emotional, event-based information over time (Hirst et al., 2009). The rates of forgetting in this study converge with diary studies of AM that have shown a rate of forgetting of 20% during the first year, and around 5-10% afterwards (Talarico & Rubin, 2003).

Numerous factors influence what information is retained in memory, including emotion (e.g., Mickley Steinmetz, Schmidt, Zucker, & Kensinger, 2012), time/decay (e.g., Brown, 1958; Sharot & Yonelinas, 2008), interference (Underwood, 1957), and perceived importance (Hirst et al., 2009), amongst others. Generally speaking, emotional stimuli are better remembered than neutral stimuli, and have been shown to alter the neural activity during encoding (Mickley Steinmetz et al., 2012) and recollection (Cahill & McGaugh, 1998). The same is true for autobiographically relevant events, in which emotional AMs are remembered more vividly and in more detail than relatively neutral events (D'Argembeau, Comblain, & Van der Linden, 2003; Schaefer & Philippot, 2005). At present, it is unclear whether positive words/memories are remembered in more detail than negative words/memories as some studies support this notion (e.g., Brewin, Reynolds, & Tata, 1999), whereas other studies support the opposite (e.g., Lemogne et al., 2006; see van Vreeswijk & de Wilde, 2004 for a meta-analysis). A recent meta-analysis showed an age-related positivity effect in which older adults exhibit an information processing bias towards positive information rather than negative information (Reed, Chan, & Mikels, 2014). Regardless of how valence affects recall, it is clear that emotional material enhances recollection in comparison to neutral material. Some studies have found that emotion impacts different aspects of memory (Sharot & Yonelinas, 2008). For example, one experiment required that participants study emotional and neutral pictures and recall them immediately, or after a 24-hour delay while providing remember/know judgments (Sharot & Yonelinas, 2008). Furthermore, participants also had to judge whether what they studied occurred during one of two supplementary tasks (contextual information). The data showed that emotional pictures were better recollected ("remember") than neutral pictures following a delay than after immediate recall, while memory for the tasks performed during encoding did not differ between emotional and neutral pictures (Sharot & Yonelinas, 2008). Based on these data, it would seem that the impact of emotion at encoding slows forgetting for the recollective experience, while having no effect on the recollection of contextual details.

One critical issue in studying AM has been that researchers have had an exceptionally difficult time distinguishing between autobiographical and episodic memories. As described in detail above, AM has been conceptualized as separate from yet reliant on the interplay between episodic and semantic memory (Fivush, 2010; Nelson & Fivush, 2004), a superordinate category of episodic memory (Conway, 2005), and a subordinate category of episodic memory (Tulving, 1972). It seems that the one consistent viewpoint for AM is that the memories must be inherently related to the self, whereas episodic memories may involve happenings that do not contribute to one's sense of self (e.g., Brewer, 1986), even though both involve autonoetic consciousness (Tulving, 1985). In the context of OGM as it pertains to depression, the vast majority of studies have not examined the contribution of episodic memory to AM performance (but see Söderlund et al., 2014, for a notable exception). Thus, OGM may reflect impaired episodic memory rather than a unique area of impairment in depression. For the present study, the term event memory is used as a bridge between episodic and AM. Indeed, episodic memory impairments are well documented in depression (e.g., McDermott & Ebmeier, 2009) and as a result, impoverished "AM" that presents as OGM should not be surprising. Imaging work and meta-analyses have shown that a core network underlies a number of higher-order cognitive processes including AM, prospection (future-oriented thinking), navigation, theory of mind, and the default mode (Spreng, Mar, & Kim, 2009). Typically, the neural overlap between episodic and autobiographical remembering is substantial and includes subsections of the prefrontal cortex including the medial and ventrolateral areas, regions of the retrosplenial and posterior cingulate, medial and lateral temporal areas, the temporoparietal junction and the cerebellum (Svoboda, McKinnon, & Levine, 2006). Truly defining the difference between AM and episodic memory is beyond the scope of this dissertation, however, examining OGM as the result of poor episodic memory is something that warrants investigation and is of central importance to the present study.

The current study had four related goals. The first goal was to replicate the OGM effect in depression in an analogue sample of dysphoric undergraduates, as has been done in other studies (e.g., Ramponi et al., 2004), through standard autobiographical methods (e.g., AI, Levine et al., 2002). To this end, OGM would be represented by a stable pattern of relatively little semantic information across events, and a dearth of episodic information from perceptual, place, time, and event-related details. In using the AI, OGM would manifest most clearly as memory responses with either few internal details or an excess of external details (defined below). The second goal was to determine whether the OGM effect for very recent autobiographical experiences (i.e., that same morning) would show that the 24-hour delay in forming AMs – as stipulated by the SMS proposed by Conway (2005) – is an arbitrary cut-point, and that the OGM effect is present almost immediately. The third goal was to use a prose reading task and a delay manipulation to show that these "AM" impairments are also observed in typical episodic memory tasks. The final goal was to use a delay manipulation to demonstrate that the OGM effect is observed in healthy individuals when memory strength is weaker. That is, after a delay, non-dysphoric individuals should report more "overgeneral" accounts of previously read prose. Thus, the purpose of this particular experiment was to test whether decreased memory performance for events and prose can translate to a similar overgeneralization of memory as observed in the OGM reports by those with depression.

Method

Participants

Participant recruitment and inclusion/exclusion criteria were the same as for Study 1. A total of 60 participants enrolled in this study. One participant declined to be audio recorded, and was excluded from the analyses. Thus, the final sample size was 59 participants, 34 of whom were non-dysphoric, and 25 of whom were dysphoric.

Table 3 displays the demographic characteristics of the sample. There were significantly more females than males in the sample, $\chi^2(1, N = 59) = 28.49$, $p < .001$, but the groups did not differ in their sex distribution, *ps* > .05. There was no difference between groups on age. Full-scale IQ scores were estimated using the Matrix and Information subscales of the Wechsler Adult Intelligence Scale – Third Edition (WAIS-III; Wechsler, 1997); no group differences were detected. Similarly, there were no differences in verbal fluency between the groups, as measured by the Controlled Oral Word Association Task (COWAT; Benton & Hamsher, 1976).

Significant differences were observed for clinical characteristics: the dysphoric group had higher scores on the total DASS-21 scores, $t(57) = 5.63$, $p < .001$, as well as on all the subscales, depression, $t(57) = 10.93$, $p < .001$, anxiety, $t(57) = 3.06$, $p < .01$, and stress, $t(57) = 2.65$, $p = .01$. On the DASS-21 subscales, the dysphoric group scored in the moderate range for depression and anxiety, and in the mild range for stress, whereas the non-dysphoric group scored in the normal range for all subscales (see Table 4). Similarly, on the PAI, differences were observed on the PAS, $t(57) = 2.52$, $p < .05$, PIM, $t(57) = 2.05$, $p < .05$, and NIM scales, $t(57) = 2.41$, $p < .05$, but not the DRG or ALC subscales. The dysphoric group scored in the moderate range for the total score, whereas the non-dysphoric group scored in the normal range. On the NIM subscale, the dysphoric group scored in the mild range whereas the non-dysphoric group scored in the normal range. Despite a statistical difference between the groups on the PIM subscale, both groups scored in the same range (normal). Given the target population in the study, these differences on the PAI are unsurprising.

Procedure

Time One

Time 1 refers to each participant's first visit to the laboratory for testing in which they completed a counterbalanced autobiographical event recall and an episodic memory task (see below for more information). Time 2 refers to each participant's second visit that always occurred exactly 7 days later, in which they completed the remaining autobiographical event recall and episodic memory task.

General. All participants had the opportunity to consent to having their responses for the AM and episodic memory tasks audio recorded for transcription and analysis. Participants completed a battery of neuropsychological, cognitive, and clinical measures at Time 1.

Autobiographical interview. In a counterbalanced fashion, participants were asked in the AI (Levine et al., 2002) to describe their morning from the present day in as much detail as possible, or provided a description of their morning from three days ago. After the interview, participants provided subjective ratings on a 1-10 scale on aspects of recollection, such as difficulty recalling the memory in question, or the degree to which visual/auditory or emotional aspects of the memory were re-experienced.

Autobiographical Interview: Free Recall

In the free recall phase, participants were asked to talk extemporaneously about the specified event that either occurred three days previous or occurred on the present day. Participants spoke uninterrupted until they came to a natural ending point (e.g., "and that's everything I remember"). The order of recollection was counterbalanced across participants, such that half of the participants talked about an event from three days ago at Time 1 and event from the same day at Time 2, while the other half received the reverse order.

Episodic memory task. Following the AI, participants read one of two 2,500-word fictitious short stories with a number of quantitative targets (e.g., time) accompanied by an appropriate lexical descriptor (e.g., 7:05, after sunrise). Using the Flesch-Kincaid Reading Ease (Flesch, 1948; Kincaid, Fishburne, Rogers, & Chissom, 1975) formula for readability, Story A scored 80.8/100, indicating an easy level of readability. Story A was the same story used in Study 1 of this dissertation. Pooling across several measures of grade-level, Story A scored an average grade level of 5.8, indicating that an individual with a fifth grade education would be able to understand the document. Story B scored 84.3, indicating an easy level of readability. Its average grade level was 5.4. The stories did not differ statistically on measures of readability, grade level, or length. Immediately after reading the story, participants were asked a series of questions related to the story. The nature of Story A involved a police interview following a night out, while Story B was about an individual looking to buy a house. Participants were asked to freely recall as many details from the story as possible, and upon finishing their recall, to provide a subjective confidence rating for each statement they had made. During the free recall of the fictitious story, the experimenter wrote down each "information bit" reported by the participant. After the participant finished recalling the story, or 10 minutes expired, each statement was read back to the participant and a confidence rating was then generated. Participants then read the second story of equal length, which they were asked to recall after a delay of one week. The same explicit instructions to remember the story were provided.

Time Two

Autobiographical interview. When participants returned to the laboratory exactly seven days later for their second testing session, they were asked to describe a different autobiographical event than from their first visit (e.g., the present morning, or the morning from three days ago). I avoided having participants recall an event from one week ago, as having been at the previous testing session may have provided a benefit to their recall (e.g., they could recall going through the experiment).

Episodic memory task. Participants recalled the second story that they had read at their Time 1 visit to the laboratory (the one which they did not already recall). They were asked the same set of questions based on the information from the second story, and were asked to provide confidence ratings for their answers.

Data Analysis

Before data analysis, all data were checked for entry errors, missing values, outliers, and examined for violations in parametric assumptions. All assumptions were met. One participant refused audio recording of their interview, and was excluded from data analysis. The analyses were conducted on a total of 59 participants. All analyses were completed using SPSS version 21. Alpha was set to .05. If there was a violation of sphericity, I applied the Huyn-Feldt corrected degrees of freedom.

AI and EMT scoring procedure. For a detailed outline of the scoring procedure, please see Levine et al. (2002). Audio recordings were transcribed and then segmented into details or informational bits that were categorized most broadly as internal or external. Internal details are synonymous with episodic details in that they reflect one of five key components to episodic memory: event, time, place, perceptual, and emotion/thought. Details were considered internal only if they were related to the main event being recalled. External details, in contrast, consisted of details unrelated or tangential to the event being recalled and also include semantic facts, repetitions, or metacognitive statements (e.g., “I am not sure of the exact order”).

Transcribed memories were placed separately in a common pool and scored at random by two experienced raters who had achieved high inter-rater reliability (r = .99 for internal details; r = .98 for external details; r = .98 for ratings of richness/integration; r = .99 for number of details) across the training memory set recommended by Levine et al. (2002). A further 20 memories were scored in a similar way for the EMT, and similar levels of reliability were obtained (r = .99 for correct details; r = .99 for incorrect details; r = .87 for ratings of richness/integration; r = .99 for number of details). In instances of scoring discrepancies, the raters resolved the issues through a discussion. See Figure 3 for an example of a dysphoric and non-dysphoric AI transcription.

Results

Autobiographical Interview: Memory Characteristics

Ease of recall. A 2 (Group) × 2 (Delay) repeated measures ANOVA was conducted using subjective ratings on the ease with which memories were recollected. A significant main effect of Delay was found, F (1, 57) = 34.61, $p < .001$, $\eta_p^2 = .38$ (Ease of recall at immediate recall = 8.7, ease of recall delayed recall 2 = 6.9; higher scores indicate an easier score). Both groups had greater difficulty recalling events after a delay. There were no group differences F (1, 57) = 0.20, $p > .05$, $\eta_p^2 < .01$ or interactions F (1, 57) = 0.26, $p > .05$, $\eta_p^2 < .01$.

Recollection of perceptual aspects. A 2 (Group) × 2 (Delay) repeated measures ANOVA was conducted using subjective ratings on the vividness of recollected visual images and sounds from the events recalled. A significant main effect of Delay was found, F (1, 57) = 8.66, $p < .01$, $\eta_p^2 = .13$ (vividness at immediate recall = 7.66, vividness at delayed recall = 6.44). There was also a significant interaction of Group and Delay, F (1, 57) = 4.80, $p < .05$, $\eta_p^2 = .78$ (non-dysphoric immediate recall = 8.00, dysphoric immediate recall = 7.20; non-dysphoric delayed recall = 6.08, dysphoric delayed recall = 6.92). There was no main effect of Group F (1, 57) = 0.01, $p > .05$, $\eta_p^2 < .01$. Follow-up *t*-tests between groups failed to reach significance at either delay. However, paired t-tests contrasting Time 1 and Time 2 performance revealed that the dysphoric group was affected to a larger extent by the delay, $t(24) = 3.34$, $p < .01$, $\eta_p^2 = .12$, whereas the non-dysphoric group was not significantly affected, $t(33) = .73$, $p > .05$, $\eta_p^2 < .01$.

Recollection of thoughts and feelings. A 2 (Group) × 2 (Delay) repeated measures ANOVA was conducted using subjective ratings on the vividness of recollected thoughts and feelings from the events recalled. A significant main effect of Delay was found, $F(1, 57) = 26.44$, $p < .001$, $\eta_p^2 = .32$ (immediate recall = 8.11, delayed recall = 6.50), in which groups had less vivid recollection of their thoughts and feelings after a delay. There was no effect of Group $F(1, 57) = 0.03$, $p > .05$, $\eta_p^2 < .01$, and no interaction $F(1, 57) = 1.38$, $p > .05$, $\eta_p^2 = .02$.

Recollection perspective. Both groups were equally likely to see themselves from a first- or third-person view, regardless of delay; non-dysphoric group, χ^2(1, N = 34) = 1.06, $p > .05$; dysphoric group, χ^2(1, N = 25) = 3.24, $p > .05$.

Time integration. Time integration is measured by a trained scorer's perception of how well a given memory integrates an event into a cohesive and unified experience. A 2 (Delay) × 2 (Group) repeated measures ANOVA was conducted with objective scorer's ratings of time integration as the DV. There was a main effect of Delay, F (1, 57) = 93.74, $p < .001$, $\eta_p^2 = .62$ (immediate recall = 1.69, delayed recall = .46), and a main effect of Group, F (1, 57) = 7.52, $p < .01$, $\eta_p^2 = .12$ (non-dysphoric = 1.23, dysphoric = .86). The interaction was not significant, F (1, 57) = 1.18, $p = .28$, $\eta_p^2 = .02$. The main effect of Delay indicated that over time, both groups had more difficulty integrating their memory into a broader context. The main effect of Group showed that the dysphoric group was virtually unable to integrate events into a broad context, whereas the non-dysphoric group integrated information adequately.

Episodic Richness. Episodic richness is measured in the same way as time integration, but it takes the composite of all detail categories into consideration when assigning a score. A 2 (Delay) × 2 (Group) repeated measures ANOVA was conducted using objective scorer's ratings of episodic richness as the DV. A main effect of Delay emerged F (1, 57) = 104.72, $p < .001$, $\eta_p^2 = .65$ (immediate recall = 3.96, delayed recall = 1.62). There was also a main effect of Group, F (1, 57) = 8.93, $p < .01$, $\eta_p^2 = .14$ (non-dysphoric = 3.12, non-dysphoric = 2.36). There was no interaction, F (1, 57) = 0.28, $p = .60$, $\eta_p^2 < .01$. The same pattern emerged as in the time integration analysis, whereby both groups performed worse after a delay. The main effect of group showed that the dysphoric group performed much worse at both time points, compared to the non-dysphoric group.

Autobiographical Interview: Free Recall

A 2 (Group) × 2 (Delay) × 2 (Detail Type, internal or external) mixed-factors ANOVA was conducted with the number of details recalled as the DV. The main effect of Delay was significant, F (1, 57) = 35.22, $p < .001$, $\eta_p^2 = .38$ (immediate = 20.29, delay = 12.19), as was the main effect of Detail Type, F (1, 57) = 289.32, $p < .001$, $\eta_p^2 = .84$ (internal = 30.55, external = 2.43). There was no main effect of Group, F (1, 57) = 2.53 $p > .05$, $\eta_p^2 < .04$). However, a significant interaction was found between Delay and Group, F (1, 57) = 10.86, $p < .01$, $\eta_p^2 = .16$ (from this interaction: non-dysphoric immediate = 19.59, delay = 15.98; dysphoric immediate = 21.00, delay = 8.40). There was also a significant interaction between Detail Type and Group, F (1, 57) = 4.14, $p < .05$, $\eta_p^2 = .07$ (non-dysphoric internal = 33.25, external = 2.32; dysphoric internal = 26.86, delay external= 2.54). The three-way interaction was significant between Delay, Detail Type, and Group, F (1, 57) = 8.27, $p < .01$, $\eta_p^2 = .13$ (see Figure 4). A follow up 2 (Delay) × 2 (Group) simple ANOVA using internal details as the DV showed a main effect of Delay, F (1, 57) = 39.63, $p < .01$, $\eta_p^2 = .41$, and a significant interaction between Delay and Group, F (1, 57) = 9.82, $p < .01$, $\eta_p^2 = .15$; a moderate main effect of Group did not reach significance, F (1, 57) = 3.30, $p = .07$, $\eta_p^2 = .06$. The same analysis was run using external details as the DV and no significant differences emerged. Follow up t-tests for the Delay × Group interaction on internal details showed that both groups recalled fewer details after a delay: dysphoric group $t(25) = 5.01$, $p < .001$; non-dysphoric group $t(34) = 3.11$, $p < .01$. This interaction between Delay and Group was due to the dramatic decline in the amount of internal details recollected at the three-day delay for the dysphoric group when compared to the non-dysphoric group, $t(57) = 4.69$, $p < .001$, $d = 1.29$; at immediate recall, there were no group differences on this measure $t(57) = -.36$, $p = .72$, $d = .09$.

A 2 (Group) × 2 (Delay) × 5 (Detail Type: event, time, perceptual, place, thought/emotion) mixed-factors ANOVA was conducted with the number of details recalled as the DV. This analysis was conducted to examine more clearly the subcategories of internal and external details. The main effect of Delay was significant, $F\ (1, 57) = 39.63$, $p < .001$, $\eta_p^2 = .41$, as was the main effect of Detail Type, $F\ (4, 57) = 248.10$, $p < .001$, $\eta_p^2 = .81$. There was no main effect of Group, $F\ (1, 57) = 3.30$ $p > .05$, $\eta_p^2 < .06$). However, a significant interaction was found between Delay and Group, $F\ (1, 57) = 9.82$, $p < .01$, $\eta_p^2 = .15$. There was also a significant interaction between Delay and Detail Type, $F\ (4, 57) = 32.95$, $p < .01$, $\eta_p^2 = .36$. The three way interaction was also significant, $F\ (4, 228) = 8.10$, $p < .01$, $\eta_p^2 = .12$. Event details made up the majority of reported details in the above analysis, and were contributing significantly to the overall finding. When event details were removed from the above analysis, the main effect of Delay, $F\ (1, 57) = 18.84$, $p < .01$, $\eta_p^2 = .25$, and the main effect of Detail Type, $F\ (3, 57) = 15.96$, $p < .01$, $\eta_p^2 = .22$ remained significant. Similarly, the interaction between Delay and Group remained significant, $F\ (1, 57) = 4.85$, $p < .05$, $\eta_p^2 = .08$. Follow-up t-tests indicated that after a delay the dysphoric individuals reported significantly fewer place $t(57) = 2.14$, $p < .05$ (dysphoric = 1.04; non-dysphoric = 2.44) and time $t(57) = 4.17$, $p < .01$ (dysphoric = 1.52; non-dysphoric = 3.44) details compared to the non-dysphoric individuals.

Detail categories. A 9 (Detail Category) × 2 (Delay) × 2 (Group) repeated measures ANOVA, with the overall number of details as the DV was conducted. Here, Mauchly's test indicated that the assumption of sphericity had been violated $\chi^2(35) = 900.15$, $p < .001$, and therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .16$). A main effect of Detail Category was discovered, $F\,(1.25, 71.08) = 248.38$, $p < .001$, $\eta_p^2 = .81$ (event details were 90% of information recalled, all other categories totaled the final 10%). This main effect is in keeping with previous literature, showing that event details tend to be reported much more than the perceptual, location, time, thought, and other details (e.g., Levine, Svoboda, Hay, Winocur, & Moscovitch, 2002). Similarly, there was a significant interaction between Delay and Detail Category, $F\,(1.37, 78.18) = 33.34$, $p < .001$, $\eta_p^2 = .37$, that was qualified by a three-way interaction between Detail Category, Delay, and Group, $F\,(1.37, 78.18) = 7.81$, $p < .01$, $\eta_p^2 = .12$. Following up with a simple 9 (Detail Category) × 2 (Group) repeated measures ANOVA with Time 1 details as the DV, a main effect for Detail Category was significant $F\,(1.21, 69.14) = 175.02$, $p < .001$, $\eta_p^2 = .75$. There was no main effect of Group $F\,(1, 57) = 0.20$, $p > .05$, $\eta_p^2 < .01$, and no interaction, $F\,(1.21, 69.14) = 0.26$, $p > .05$, $\eta_p^2 < .01$. Using the same analysis with Time 2 details as the DV, there was a main effect of Detail Category, $F\,(1.49, 84.95) = 138.89$, $p < .001$, $\eta_p^2 = .71$. There was also a main effect of Group, $F\,(1, 57) = 20.37$, $p < .001$, $\eta_p^2 = .26$, and an interaction between Detail Category and Group, $F\,(1.49, 84.95) = 16.24$, $p < .001$, $\eta_p^2 = .22$. Follow up t-tests indicated that after a delay the dysphoric group had fewer event details $t\,(50.49) = 4.90$, $p < .001$, fewer place details $t\,(48.90) = 2.36$, $p < .05$, and fewer time details t

(56.11) = 4.45, $p < .001$ compared to the non-dysphoric group. Critically, there were no differences between these three latter detail categories at Time 1.

Autobiographical Interview: General Probe

After participants had come to a natural ending point in the interview, they were asked up to two additional questions to elicit more detail (e.g., "is that all you remember?"). A 2 (Delay) × 2 (Detail Type) × 2 (Group) repeated measures ANOVA was conducted with the number of details recalled after the probe as the DV. The main effect of Delay was significant, F (1, 57) = 39.50, $p < .001$, $\eta_p^2 = .41$ (immediate recall = 21.4, delayed recall = 12.90), as was the main effect of Detail Type, F (1, 57) = 304.16, $p < .001$, $\eta_p^2 = .84$ (internal = 31.57, external = 2.73). Again, there was no main effect of Group F (1, 57) = 2.33, $p > .05$, $\eta_p^2 = .04$). As in the Free Recall results, the interaction between Delay and Group remained significant, F (1, 57) = 10.37, $p <. 01$, $\eta_p^2 = .15$ (non-dysphoric immediate = 20.72, delay = 16.57; dysphoric immediate = 22.08, delay = 9.22). There was no longer a significant interaction between Detail Type and Group, F (1, 57) = 3.87, $p > .05$, $\eta_p^2 = .06$. An interaction between Delay and Detail Type remained significant, F (1, 57) = 46.85, $p < .001$, $\eta_p^2 = .45$ (immediate internal = 40.29, delay internal = 22.84; immediate external = 2.51, delay external = 2.95). The three-way interaction remained significant between Delay, Detail Type, and Group, F (1, 57) = 8.06, $p < .01$, $\eta_p^2 = .12$. Overall, the general probe section did little to change the effects observed in the free recall phase.

Episodic Memory Task

Using the overall number of details recalled from the transcripts as the DV, a 2 (Delay) × 2 (Detail Type) × 2 (Group) repeated measures ANOVA was conducted. There were significant main effects of Delay, F (1, 57) = 120.75, $p < .001$, $\eta_p^2 = .68$ (immediate = 31.25, delay = 9.64), Detail Type, F (1, 57) = 197.87, $p < .001$, $\eta_p^2 = .78$ (internal = 29.85, external = 11.04), and Group, F (1, 57) = 10.27, $p < .01$, $\eta_p^2 = .15$ (non-dysphoric = 24.02, dysphoric = 16.87). Moreover, a significant Delay × Group interaction emerged, F (1, 57) = 4.34, $p < .05$, $\eta_p^2 = .07$ (non-dysphoric immediate = 31.65, delay = 16.40; dysphoric immediate = 28.06, delay = 5.68). Follow-up t tests indicated that the dysphoric group recalled fewer details after the delay, t(57) = 6.54, $p < .001$, d = 1.7 . There was also a significant interaction between Detail Type and Group, F (1, 57) = 9.72, $p < .01$, $\eta_p^2 = .15$ (non-dysphoric internal = 37.22, external = 10.82; dysphoric internal = 25.28, external = 8.46). The follow up t tests indicated that the dysphoric group recalled fewer internal details than the non-dysphoric group t(57) = 3.61, p = .001, d = 0.95; there were no differences for external details. Finally, a Delay × Detail Type interaction was significant, F (1, 57) = 28.43, $p < .001$, $\eta_p^2 = .33$ (immediate internal = 44.78, delay internal = 14.93; immediate external = 14.93, delay external = 4.35; see Figure 5 for all interactions). For the Delay by Detail Type interaction, follow up paired sample t tests, indicated that more internal details were recalled overall when compared to external details at immediate recall, t(58) = 10.63, $p < .001$, d = 2.52; more internal than external details were also recalled after the delay, t(58) = 10.26, $p < .001$, but with a smaller effect size, d = 1.48, suggesting that the gap between internal and external details decreased over a delay. This may be due to the fact that external details were near the floor. The three-way interaction was not significant F (1, 57) = 2.30, $p > .05$, $\eta_p^2 = .04$.

Next, a 2 (Delay) × 2 (Detail Type) × 2 (Group) repeated measures ANOVA was conducted using *correctly* recalled details as the DV. The results from the previous analysis remained consistent throughout this ANOVA, and as such, only the main effect and interactions are discussed for the sake of completion, and no follow up analyses will be reported as the pattern of results were unchanged. The main effect of Delay was significant, $F\ (1, 57) = 118.25$, $p < .001$, $\eta_p^2 = .68$ (immediate = 27.48, delay = 9.60), as was the main effect of Detail Type, $F\ (1, 57) = 176.94$, $p < .001$, $\eta_p^2 = .76$ (internal = 28.22, external = 8.87). There was also a main effect of Group, $F\ (1, 57) = 9.98$, $p < .01$, $\eta_p^2 = .15$ (non-dysphoric = 21.92, dysphoric = 15.17). There was a significant interaction between Group and Delay, $F\ (1, 57) = 4.86$, $p < .05$, $\eta_p^2 = .08$ (non-dysphoric immediate = 29.04, non-dysphoric delay = 14.79; dysphoric immediate = 25.92, dysphoric delay = 4.42). There was also a significant interaction between Group and Detail Type, $F\ (1, 57) = 10.19$, $p < .01$, $\eta_p^2 = .15$ (non-dysphoric internal = 33.91, external = 9.93; dysphoric internal = 22.52, external = 7.82). There was also a significant interaction between Delay and Detail Type, $F\ (1, 57) = 33.65$, $p < .001$, $\eta_p^2 = .37$ (immediate internal = 41.23, immediate external = 13.74; delay internal = 15.21, delay external = 4.01). The three-way interaction was not significant ($F = 2.63$, $p = .11$).

The same 2 (Delay) × 2 (Detail Type) × 2 (Group) repeated measures ANOVA was conducted using *incorrectly* recalled details as the DV. Only the main effects of Delay, $F\ (1, 57) = 9.23$, $p < .01$, $\eta_p^2 = .14$ (immediate = 2.37, delay = 1.43), and Detail Type, $F\ (1, 57) = 70.01$, $p < .001$, $\eta_p^2 = .55$ (internal = 3.03, external = .77), were significant, in which participants recalled fewer incorrect details after a delay, and fewer external than internal details (figure not shown). This effect, however, was due to the fact that the frequency of recalling incorrect information was low at immediate recall, and almost non-existent at delayed recall (e.g., x = .34 at delay across groups). From a signal detection perspective, this suggests that participants were good at limiting the number of false positives they reported at both times (e.g., made few commission errors).

Confidence. A 2 (Delay) × 2 (Accuracy) × 2 (Group) repeated measures ANOVA was conducted using confidence, or perceived accuracy as the DV. A significant main effect of Delay emerged, F (1, 57) = 58.21, $p < .001$, $\eta_p^2 = .51$ (immediate = 76.14, delay = 39.96), as did a significant main effect of Accuracy, F (1, 57) = 37.01, $p < .001$, $\eta_p^2 = .39$ (immediate = .72, delay = .43). Also, there was a significant main effect of Group, F (1, 57) = 4.56, $p < .05$, $\eta_p^2 = .07$ (non-dysphoric = 63.06, dysphoric = 53.05). As shown in Figure 6, these main effects reflected that participants had more confidence in their answers to correct compared to incorrect responses, confidence was generally greater at immediate compared to delayed recalled, and the dysphoric group had less confidence in their responses compared to the non-dysphoric group.

Subjective ratings of richness. Repeated measures ANOVAs were conducted to examine the group differences in the subjective ratings of richness outlined in the Autobiographical Memory Interview (AMI; Kopelman, Wilson, & Baddeley, 1990), the AI (Levine et al., 2002), as well as the ability to integrate time-related details into the story. First, a 2 (Delay) × 2 (Group) ANOVA using the AMI richness scale as the DV was conducted, which revealed a main effect of Delay, F (1, 57) = 84.52, $p < .001$, $\eta_p^2 = .60$ (immediate = 2.14, delay = 1.15; see Table 5). A significant main effect of Group was also observed: F (1, 57) = 6.13, $p < .05$, $\eta_p^2 = .10$ (non-dysphoric = 1.77, dysphoric = 1.48). The same analysis was conducted using the AI richness scale as the DV, which also revealed a main effect of Delay, F (1, 57) = 104.72, $p < .001$, $\eta_p^2 = .65$ (immediate = 3.96, delay = 1.62), and a main effect of Group, F (1, 57) = 8.93, $p < .01$, $\eta_p^2 = .14$ (non-dysphoric = 3.12, dysphoric = 2.36). Using time-integration as the DV, a main effect of Delay was found, F (1, 57) = 93.74, $p < .001$, $\eta_p^2 = .62$ (immediate = 1.69, delay = .48), along with a main effect of Group, F (1, 57) = 7.52, $p < .01$, $\eta_p^2 = .12$ (non-dysphoric = 1.24, dysphoric = .86). Taken together, these data suggest overall, the dysphoric group exhibited a relatively impoverished recollection of the transcripts compared to the non-dysphoric group.

Discussion

The objective of the present study was to investigate whether impaired AM performance might simply be due to impaired episodic memory processes more generally rather than a standalone phenomenon unique to AM. In order to test this notion, I employed a delay manipulation with the intent of degrading memory traces/creating proactive inhibition (via forgetting) in two types of memory tests: the AI (Levine et al., 2002) and a challenging prose-reading episodic memory task (EMT) were performed. For the AI, participants were asked to describe in detail events that had happened either that day or an event from three days ago, whereas in the EMT, participants read a 2,500-word transcript that they recalled immediately, and then recalled an alternate transcript upon their return visit to the laboratory one week later. The data clearly support the observation that, after a delay, memory for both autobiographical events and laboratory-based stimuli declines both in terms of quantity (e.g., sheer output) and accuracy when compared to information that is recalled immediately. All the more important, findings of group differences did not emerge at immediate testing; that is, dysphoric and non-dysphoric participants performed equally well upon immediate recollection of AMs and on the EMT. After a delay, however, the performance of both groups declined, but this effect was exacerbated in dysphoric group such that the groups were no longer matched on performance. In other words, this study demonstrated that memory performance, regardless of type of memory (AM or episodic), declines as a function of time, albeit more pronouncedly in individuals with mild depressive symptoms. These data lend credence to the notion that OGM may reflect poor event memory in general and that is not specific to the autobiographical domain. More specifically, the findings in the present study show a clear delay-related difference between the groups with respect to AM performance as measured by the AI and episodic memory performance as measured by the EMT. After a delay period, the dysphoric group reported fewer internal details (i.e., details specific to one particular time and place) on both tasks compared to their Time 1 performance, and compared to the non-dysphoric group at both times. The lack of internal details is consistent with the phenomenon of OGM (Williams & Broadbent, 1986), as fewer of these details are by necessity a reduction in memory specificity.

The findings of the present study support some, but not all of the objectives that were initially set out. First, consistent with previous literature (e.g., Ramponi et al., 2004), these data replicate the OGM effect in a sample of dysphoric undergraduates. Importantly, this effect was only apparent after a delay of three days and not observed upon immediate recollection of autobiographical experiences (e.g., present day events). The fact that performance on both the AI and the EMT declined as a function of time supports the study's second objective in showing that impairments with metamnemonic and event memory operations *in general*, are a more parsimonious account of OGM. That is, rather than positing two separate memory impairments in individuals with mood related symptoms, it is more succinct to suggest that as a whole, event memory is impaired relative to individuals without mood symptoms. This quite predictably results in fewer recalled details and may also reflect the rememberer's attempt to compensate for their memory dysfunction by adjusting the grain size of memories so as to increase overall accuracy (Goldsmith & Koriat, 2008). The third objective was to show that, even in non-dysphoric individuals, a delay manipulation would impair memory performance that resembles OGM, and, indeed, the data support this hypothesis. One objective that was not met was to show that the 24-hour period for forming AMs, as proposed in the SMS (Conway, 2005) is an arbitrary cut-point. This claim of the SMS still deserves further attention, perhaps by examining a more acutely depressed sample and testing the temporal properties of OGM across a continuum via a series of recent memories (e.g., the last week), slightly less recent memories (e.g., several weeks), and remote memories (e.g., 1 year). In hindsight, attempting to test this aspect of the SMS may have been beyond the scope of the methodologies and available technology employed in the present study. First, attempting to distinguish between an AM and memory of an episodic event has proven difficult for several prominent theories (e.g., Conway & Pleydell-Pearce, 2000; Nelson & Fivush, 2004; Tulving, 1985). Suffice to say that even with the most advanced measures of AM, such as the AI, episodic events factor significantly into what is generally accepted to be AM. Indeed, the neural overlap between AM and episodic memory is substantial, yet there are some differences such as episodic memory recruiting the mid-right dorsolateral prefrontal cortex, which is typically absent from AMs, whereas left ventromedial prefrontal cortex activity is routinely observed in AM but not episodic memory (Gilboa, 2004). Furthermore, with respect to empirically examining this claim of the SMS, one would likely need to use fMRI to determine whether different neural signatures emerged for very recent to remote memories while obtaining subject ratings of each memory's importance.

Hypothesis 1 for the present study was that at immediate recall of the EMT and the AI, the dysphoric group would perform worse than the non-dysphoric group. This hypothesis was not supported, as both groups were matched on performance at Time 1 on the AI and on both outcome measures of the EMT (number of details reported and number of accurate responses). Hypothesis 2 was that both groups' performance would decline on both memory tasks as a function of time. The results from this study support this hypothesis as on the AI and EMT, fewer details were reported after a delay; further, fewer correct details were reported after a delay on the EMT, but this effect was more apparent in the dysphoric group. Hypothesis 3 was that the non-dysphoric group's performance after a delay would be on par with the dysphoric group's performance at immediate recollection. This hypothesis was closely linked to hypothesis 1, and since hypothesis 1 was not supported, neither was hypothesis 3. Instead what emerged was a pattern of memory degradation as a function of a delay period regardless of group. Notably, this pattern was more pronounced in the dysphoric group in that the delay manipulation had a much greater impact on the dysphoric group than it did to the non-dysphoric group. An interesting finding was that for the AI, the delay period seemed to affect dysphoric participants' recollection of truly episodic (e.g., place, time) details more so than non-dysphoric participants. Specifically, after a delay both groups performed worse on measures of episodic memory, but only the dysphoric group exhibited a decline in event, place, and time details when compared to their immediate recall performance. This suggests that impaired episodic memory may be the contributing factor to OGM. Hypothesis 4 was that on the EMT, confidence would decline after a delay period. Indeed, the data showed exactly that. For hypothesis 5 I posited that regardless of group, participants would have higher confidence ratings for items that they correctly reported in comparison to items that they incorrectly reported; the data supported this hypothesis. This pattern of results was also obtained in Study 1.

Data based on participants' subjective ratings of autobiographical events further support the notion of a degrading memory trace over time, as both groups reported having more difficulty recollecting experiences after the delay period compared to immediate recollection. Similarly, both groups reported "re-experiencing" to a lesser degree the perceptual and emotional aspects of the autobiographical events after a delay, when compared to events they recalled immediately. Importantly, the groups did not differ from each other on these ratings, which suggests that the effect of the delay subjectively felt the same to both groups. Finally, on the AI ratings of episodic richness, which is a subjective rating assigned by trained scorers of how well participants integrate time, place, and perceptual aspects of narrative details into an event, showed that the delay most prominently affected the dysphoric group. That is, both groups were assigned similar levels of episodic richness for their immediately recalled AMs, but after a delay the dysphoric group was less able to integrate these aspects of recollection. The same pattern was found for subjective scores on time integration, which is a measure of how well an individual can integrate the current narrative into a broader context (Levine et al., 2002). The objective data from the AI, then, points toward an effect of mood on both the amount of information recalled, as well as decreasing memory accuracy over time. To the best of my knowledge, this is the first such study to demonstrate this finding.

This study calls into question the claim that AM is a unique area of memory weakness in depression that is separate from impaired episodic memory as some authors have suggested (Burnside et al., 2004; Kuyken & Howell, 2000). Rather than continuing to divide memory into various types with specific roles, this study highlights the fact that basic memory operations (e.g., retention and output) are able to account for highly reproducible findings with a parsimonious explanation: namely that impaired OGM in MDD could be the result of having poor (episodic) memory. Rather than relying on overly complicated models of AM, the results here suggest that if an individual has poor memory in general, they should be expected to perform poorly on most measures of declarative/episodic memory. Indeed, the data here show that even healthy controls exhibit OGM after a delay, when compared to immediate recall as reflected by a decline in the number of internal details on the AI and the EMT in the presence of relatively stable external details across both time periods (although there may have been a floor effect for external details). It seems that interpreting "impaired" performance after a delay as a special deficit category in AM may not be the most parsimonious account of what may be occurring. As stated above, the decline in performance after a delay should reasonably impact all aspects of event memory, rather than just AM.

One recent study found that across four time periods (2 weeks, 1 month, 1 year, and 10 years), individuals with MDD exhibited impaired AM performance, relative to controls, as measured by the AI (Söderlund et al., 2014). Söderlund and colleagues (2014) found the same pattern of impoverished internal (episodic) details relative to spared external (semantic) details in depressed participants. Notably, the impairment observed for internal details remained stable across all time periods for the individuals with MDD; the performance of control subjects remained stable across the time periods as well. The pattern of results obtained in the present study meshes with those that were reported by Söderlund et al. (2014), in that the memory deficits become prominent after a delay. Söderlund et al. (2014) did not examine the recollection of an immediate autobiographical event; such an inclusion may have been helpful in delineating when AMs become overgeneral. These authors also found that individuals with MDD were impaired on the recollection of public events and that their recognition of information about famous people was characterized by more familiarity than it was in control participants. Of note, the Söderlund et al. (2014) study included the Brief Visuospatial Memory Test – Revised (BVMT-R) and the Hopkins Verbal Learning Test (HVLT) as measures of declarative memory and the groups did not differ on immediate performance, but *did* differ significantly after a delay. Taken as a whole, the results from Söderlund et al. (2014) suggest worse memory, in general, for events recalled after a period of time (i.e., a delay), which is in line with the findings of the current study. Here, the lack of difference between groups on immediate recall of "basic" memory tests (e.g., BVMT-R, HVLT) in conjunction with impaired performance after a delay suggests that a degraded memory trace may be one of the major factors in generating OGMs.

In the present study, the preserved immediate recall of autobiographical events may be a reflection of the fact that recent events require less cognitive effort to recollect compared to remote events (e.g., Hartlage, Alloy, Vazquez, & Dykman, 1993). As the task of recollection becomes more challenging, individuals with mood-related symptoms may be less able to recruit the necessary resources to employ effective meta-mnemonic strategies. More specifically, deficits in delayed memory performance may suggest problems with memory encoding, storage, or search processes. Indeed, Söderlund et al. (2014) suggest that due to the inclusion of cued retrieval in the AI, it seems that depressed individuals have difficulty accessing information. Another possibility is that depression may reduce hippocampal-dependent binding, as a large body of imaging research has shown that neuroanatomical changes occur within the hippocampus (e.g., Drevets et al., 2008).

It is important to consider the study limitations. First and foremost is the fact that this study was conducted with a sample of sub-clinically depressed individuals who were not administered a clinical interview. Rather, cut-points on a self-report questionnaire (DASS-21) were used to assign group status, and as such, it is possible that these groups are not fully representative of the typical AM and MDD studies (e.g., Williams & Broadbent 1986). On a similar note, the present sample is quite young and well-educated, which may not be characteristic of the average individual with MDD. However, other studies that have enrolled dysphoric college students have demonstrated impaired AM relative to non-dysphoric participants when using the AMT, which is a less sensitive measure than the AI (e.g., Dalgleish et al., 2007; Ramponi et al., 2004). Moreover, the present study showed that OGM exists for both episodic and autobiographical events after a delay; previous work with the AMT has typically not compared the recollection of recent versus remote memories. Second, only two autobiographical events were tested on the AI, both of which had occurred in the past week (present day, and three days ago). These time periods were picked to minimize the influence of the delay period on AM performance. In previous studies using the AI, events from within the past two weeks are generally not accepted because such events are considered to be too recent. Furthermore, these time periods were also picked to avoid having participants choose an event from the weekend (arguably easier to recollect), or having the memory associated from the previous testing session that may have served as an unfair retrieval cue. Finally, although great strides were taken to balance the difficulty of the EMT such that there were no floor or ceiling effects, our participants' performance tended more toward the floor. For example, in each of the transcripts, a total of approximately 150 total details could be recalled as targets but the average number of details reported at immediate recall was approximately 40, and approximately 15 at delay. Thus, participants were only reporting 26% of the information they read at immediate recall, and 10% after a delay. Nonetheless, the observed rate of forgetting of around 15% over a week is illustrative that the stimuli did an adequate job of balancing difficulty. With this rate of forgetting, both groups exhibited a steeper decline in the recollection of internal, rather than external, details, which again mirrors OGM. Further, one limitation of the present study is that the present data preclude a firm conclusion on the role of consolidation. It is plausible that the dysphoric group experiences a greater difficulty with memory consolidation than the non-dysphoric group. The methodology used in the present study, however, can only speculate on the role of consolidation. Broadly speaking, it appears, based on the matched performance at immediate performance on the AI and the EMT that encoding is spared in dysphoric individuals. The impaired performance after a delay leaves open two possibilities that include poor search/retrieval or poor consolidation. In order to address this possibility more carefully, the present study would need to be able to examine in detail the proportion of information properly encoded along with the search strategies that participants employ. In this vein, a recall/recognition experiment in the present study may have been able to illuminate this possibility.

Another limitation to the current study is the method that we used to cue AMs. Specifically, participants were asked to describe an event that happened on the present day (e.g., “tell me about what has happened so far today”) or an event that happened three days ago (e.g., “tell me about your morning/afternoon three days ago”). Recent work has shown that individuals with MTL lesions engage in the event selection process of generating AMs in a qualitatively different way than do healthy comparison participants (Lenton-Brym, Kurczek, Rosenbaum, & Sheldon, 2016). In this study, individuals with MTL lesions selected events that occurred at a higher frequency (e.g., getting hair cut) than did healthy controls. The authors of this study interpreted this finding to be a compensatory mechanism used by individuals with MTL damage, allowing them to rely more on intact semantic memory processes. This finding was true both for past and possible future events. Applied to the present study, it may be that the memory cues had a disproportionately large effect on the dysphoric group in being able to generate a unique event to elaborate upon. The goal of the present study, however, was to examine the effect of a delay in “creating” OGMs. It is plausible that the results may have been affected by the somewhat vague memory cues, and that a better approach would have been to ask for events during a specified time period (e.g., “Tell me about what happened between 9:00 and 1:00 on Thursday”). At this point, it is difficult to say for certain whether the dysphoric group was put at a disadvantage at the outset of the AI. Although it is theoretically possible that the cues used in the present study were unfair to the dysphoric group, it seems unlikely that the impact would be able to account for the entire set of results. Indeed, as Lenton-Brym et al. (2016) showed, even in individuals with MTL damage, the events did not differ from healthy comparison subjects for aspects of event significance, uniqueness, imageability, and emotionality. Nonetheless, the somewhat vague cues in the present study may have contributed to some of the results.

There is evidence that the cue method impacts performance in dysphoric individuals, however. One recent study found that dysphoric individuals were overgeneral the classic AMT cue-word methodology for both past and future events; using a sentence completion method, future events were only overgeneral when emotional words were used (Anderson, Boland, & Garner, 2016). Other recent studies, however, show that cue method has little effect. For example, no differences in memory specificity were observed in depressed individuals when using pictorial or verbal cues (Ridout, Dritschel, Matthews, & O'Carroll, 2016). Another study recently found that the interaction between self-relevance, valence, and depression scores accounted for differential performance between dysphoric and non-dysphoric participants on the AMT (Matsumoto & Mochizuki, 2016). Taken together, it is clear that the cueing of AMs can impact performance, although much remains to be learned about the many nuances that might contribute to OGM.

Finally, the present study did not include a standard episodic memory task, such as the California Verbal Learning Test, to examine group differences. The inclusion of this sort of test would be highly recommended for any future studies examining AM and episodic memory. One recent study found that at immediate testing, depressed and non-depressed individuals performed equally well on the BVMT-R and HVLT, but that group differences emerged after a delay such that the depressed individuals performed significantly worse after a delay (Söderlund et al. 2014). This pattern of findings mirrors the results of the present study for both the EMT and the data from the AI.

The present study demonstrated that OGM is evident for both autobiographical events and for episodic laboratory-based stimuli as a function of time and as indexed by fewer internal details; this effect was more pronounced in the dysphoric group in the present study. Taken together, these data suggest that OGM is not specific to AM, but rather, is a general feature of forgetting and perhaps the direct and predictable result of memory impairment. Data from the EMT used in this study also showed that confidence for event memory accuracy declined over time, for both groups. This finding might suggest that memory monitoring (as in Study 1) is relatively spared in individuals with mood-related symptoms, suggesting awareness that their memory is impaired. One aspect of memory performance not addressed by the present study is the role that memory search operations may play in OGM. In the study that follows, memory search operations are examined for autobiographically relevant information.

Group: Dysphoric

Tell me everything you remember about your day 3 days ago.

I woke up. I was supposed to wake up around 9:00, but it was about 10 or 10:30. I did my morning routine. I had class at 11:00. I had to walk to school because I missed the bus. It takes the same amount of time. I sat in class for 2 hrs. It was boring. I had to meet with my group for a presentation. We met for 2 hours in 1 room, and got kicked out for 10 minutes, then got kicked out again for another 20 minutes. Then we worked in the lobby.

After I went to my girlfriends place, and we hung out. Then we went to the roleplay café for dinner, and played some board games. We played cheat, guess who, and rummy. I had a coke with a lemon. She had a meat lovers pizza. I had pulled pork. That's a recent phenomenon for me. We stayed for about 3 hours. We then watched some tv, and called it a night.

Anything else?

I felt that I was late for everything that day, like most days.

Group: Non-Dysphoric

Tell me everything you remember about your day 3 days ago

I woke up and went right into the shower. Came out and got dressed. I brushed my teeth, washed my face with moisturizer, and then put my make up on. I left way too early. I went down the stairs and through the hall to my elevator. I pressed ground and came out of the elevator and then out of my building and walked 2 blocks to the bus stop. There was a guy in the elevator blasting his iPod. I thought that was obnoxious. I hopped on the 76 bus up to Royal York. It takes me about 20 minutes – usually – to get there. But there was little traffic that day, so it only took about 15. Almost no one pushed the stop button. It was great. I sat near the back. Second last seat. I got to the station and went down the escalators and got on the eastbound train. I got off at Yonge and stood the entire way. When I transferred, I had to keep standing. I was kind of frustrated because it was quite warm. Then I went to get coffee at McDonald's using one of the 7-day coupon thing. I got a large triple-triple. I left Eaton's centre and got to my psych class 75 minutes early. It was 7:45. I sat in the third row up, and started reading the news paper. I almost finished, but it got too noisy so I turned on my computer and looked at twitter. I checked my.ryerson and my gmail account. Then I took lots of notes. I left the George Varie building, and took the subway back home.

Anything else?

Nope.

Figure 3. Examples of event descriptions from dysphoric and non-dysphoric participants at a three-day delay.

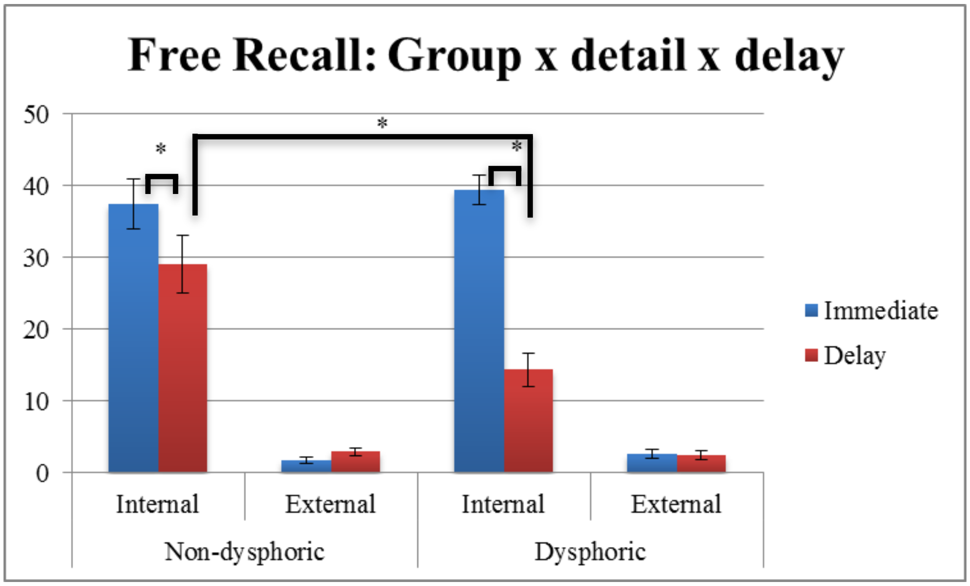

Figure 4. Three-way interaction during the free recall phase of the Autobiographical Interview, using the total number of details recalled as the DV. Internal details refer to events central to the memory at hand, whereas external details refer to events unrelated to the primary memory being recalled.

Table 4
Demographic and Cognitive Characteristics of the Participants

	Non-dysphoric $n = 34$		Dysphoric $n = 25$	
Demographic Data				
Male/Female	5 / 29		4 / 21	
	M	*SD*	*M*	*SD*
Age	19.24	1.81	21.08	7.65
Cognitive Performance				
WAIS Info*	11.76	2.19	12.48	1.81
WAIS Matrix*	10.26	2.12	10.84	1.70
COWAT**	40.94	10.90	36.12	11.13
Clinical Characteristics				
PAI PAS ^{t}	39.82	24.08	57.05	28.32
PAI ALC	46.76	7.32	49.60	7.41
PAI DRG	48.24	9.92	48.56	7.58
PAI PIM ^{t}	41.15	9.36	36.20	8.86
PAI NIM ^{t}	49.65	5.98	54.72	10.12
DASS-21 Depression ^{ttt}	3.88	2.25	15.6	5.68
DASS-21 Anxiety ^{tt}	5.94	4.79	11.12	8.16
DASS-21 Stress ^{tt}	13.00	8.11	18.8	8.58

* Age-scaled standard scores ** Raw scores

PAI-related scores are P-scores from the PAS and T-scores for the PAI subscales

DASS-21 scores are sum totals

^{t} Significant at $p < .05$; ^{tt} Significant at $p < .01$; ^{ttt} Significant at $p < .001$

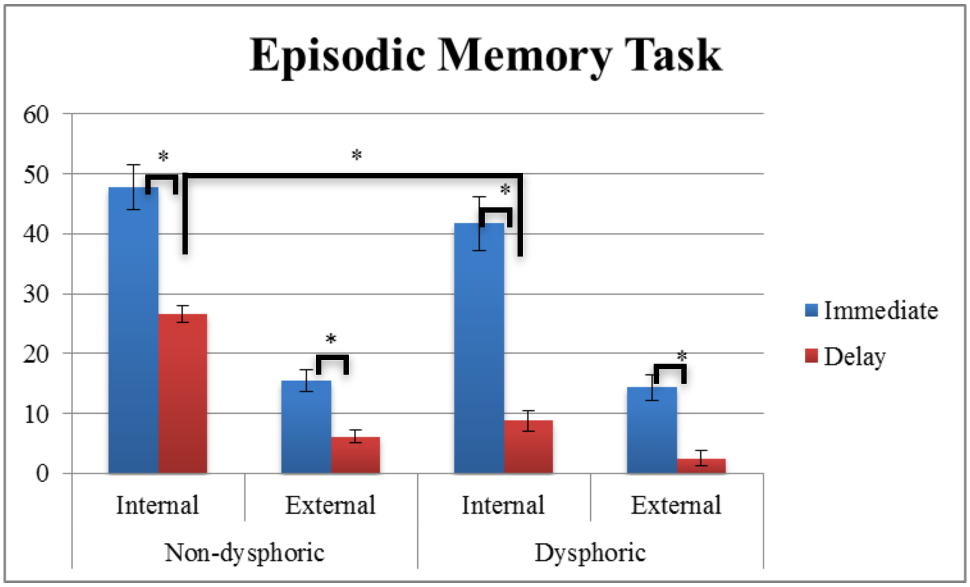

Figure 5. Two-way interactions between Delay by Detail, Delay by Group, and Detail by Group with the number of correct items recalled as the DV, during the episodic memory task.

Table 5
Descriptive statistics for measures of richness across the AI

	Non-dysphoric *n* = 34				Dysphoric *n* = 25			
	Immediate		*Delay*		*Immediate*		*Delay*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
AMI Richness	2.29	0.76	1.24	0.50	1.92	0.70	1.04	0.20
AI Episodic Richness	4.24	1.58	2.00	1.18	3.60	1.61	1.12	0.33
AI Time Integration	1.79	0.73	0.68	0.77	1.56	0.87	0.16	0.37

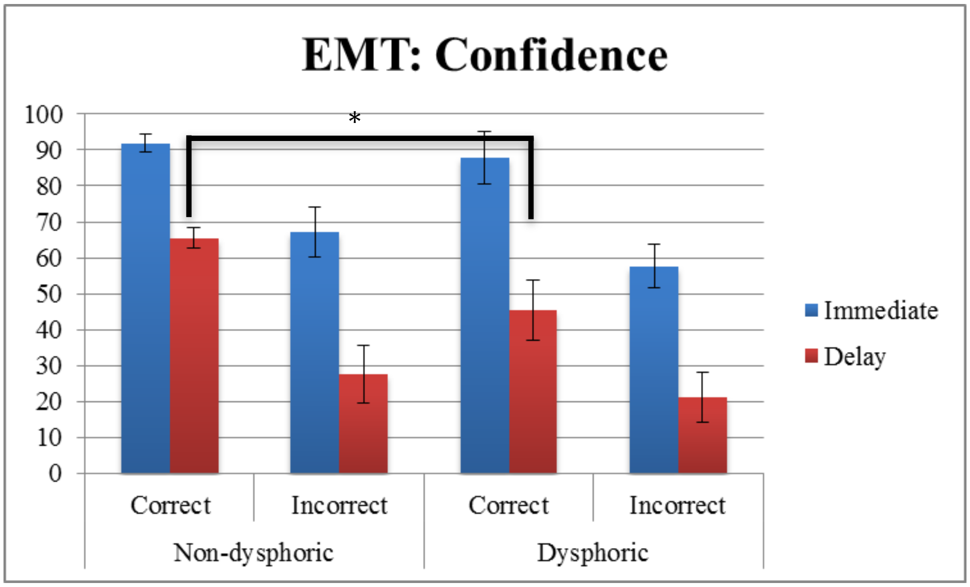

Figure 6. Main effects of Group, Detail, and Delay with confidence as DV. All differences between immediate and delay within group are significant.

CHAPTER 4: Memory Search Strategies for Autobiographically Relevant Information in Dysphoric and Non-Dysphoric Individuals

Background and Hypotheses

The act of searching one's memory is a highly demanding cognitive task. Anyone with access to a computer can likely attest to the fact that he or she has often been at a loss when trying to remember in what folder they put that *one* particular file. Numerous factors likely contribute to this experience, including source monitoring (e.g., did I have it on my home computer, or work computer?), disorganization (e.g., this time I'll put it on my desktop), poor search strategies (e.g., I'll just check folders randomly), or some combination of the three. In recent years, some researchers have argued that perhaps the most parsimonious account of memory performance mirrors our current experience with technology, in which the main function of human memory is not to *store* information, but to know *how* or *where* to access this information, while allowing technology (e.g., hard drives) to take care of the storage of information (Benjamin, 2008). Thus, what may separate effective and efficient memory use is not an individual's *memory capacity*, but rather an individual's *capacity to use* their memory. To return to the example above, it may be more efficient for the user in this situation to know that they tend to store files of a given nature in their "active projects" folder, rather than be able to recollect the specific content of the particular file. In other words, having a coherent system that allows us to work with memory may be more important than having a wealth of information that is difficult to access. This is not to say that memory as a storehouse is an inappropriate conceptualization (Atkinson & Shiffrin, 1971), but to emphasize capacity alone is to neglect the importance of higher decision-making processes in overall memory performance.

Research has also demonstrated that these strategic decision-making processes occur at multiple levels of memory, including encoding, search/retrieval, monitoring, control, and performance stages (Benjamin, 2008; Goldsmith & Koriat 2008; Goldsmith et al., 2002; Koriat & Goldsmith 1996a, 1996b). Here, our focus is on the strategic, decisions at the search stage of memory processing, specifically search organization. Strategic decisions about search and retrieval include whether to search at all, how to create a proper memory query and limit search space, and when to stop the search process (Benjamin, 2008).

Proper decisions about memory search and retrieval are even more useful when one considers the systematic inaccuracies that characterize human memory (Loftus & Palmer, 1974). Frequently, memorial inaccuracies arise due to the over consideration of similar foils. For example, in simple recognition list-learning studies using a remember/know paradigm, participants are more likely to make errors based on similarity of sound (Watson, Balota, & Sergent-Marshall, 2001), form (Underwood & Zimmerman, 1973), or meaning (Roediger & McDermott, 1995). That is, participants are more likely to falsely remember words that sound the same as a target word (e.g., cat/hat), appear similar in orthography (e.g., cough/tough), or have a similar meaning (e.g., late/tardy). Such systematic errors point towards flexibility in memory and again highlights the importance of skill in memory use. One might imagine that an organized search strategy limits the amount of errors an individual makes on a given memory task, and indeed, research supports such a supposition (Conover & Brown, 1977; Tulving & Thompson, 1973).

As a reminder to the reader, the SMS (Conway, 2003, 2005) stipulates that OGM is the result, in part, of an ineffective search strategy, in which depressed individuals abort the search process prematurely at the General Events level (Conway, 2005). Indeed, this may be an important factor related to memory impairments in depression, as there is evidence of deficits in effortful processing in depression (Hartlage et al., 1993).

Memory search occurs in two ways: direct and indirect. The first method is considered direct because it occurs when the retrieval cue is potent (i.e., the question asked by oneself), leading to quick access to information stored in one's autobiographical knowledge base (Burgess & Shallice, 1996a). By contrast, when the retrieval cue is impoverished or degraded, individuals must rely on a strategic search process designed to acquire the desired information while leaving out unnecessary information. In the latter case, more effort is required for the memory search and this may be particularly impaired in MDD (Hartlage et al., 1993). Indirect retrieval may characterize a disproportionate number of recollection efforts in depression, and may be one plausible explanation for OGM. This effortful search process has been hypothesized to be an iterative process that begins by specifying a context that may contain the desired information (Burgess & Shallice, 1996a; Conway & Pleydell-Pearce, 2000). For example, if asked to describe Christmas dinner from 2001, one may start by first determining his or her age at that time (e.g., I was 17, so I hadn't yet finished high school). At this point in the memory search, if a clear answer were not yet apparent, the search would continue to use other cues (e.g., That would have been grade 10, so I spent time with friend X). Notice how at this point in the search process, there are now two potential contexts (age and grade) that may prove useful in answering the initial question (Unsworth, Spillers, & Brewer, 2012). This iterative search process would continue until enough contexts were generated to effectively retrieve the desired information (e.g., I spent the day with friend X at their parent's house). In the context of the SMS, the search would occur as follows: Lifetime Period (high school), General Events (Christmas dinners; spending time with friend X) and finally Event Specific Knowledge (Christmas dinner with friend X in 2001 at his parent's house). Thus, the ability to generate contexts to aid in memory search is a critical aspect of memory performance (Unsworth et al., 2012). Research has demonstrated that individuals tend to generate contexts, and then search those contexts for relevant information, leading to the well-document clustering effect[1] in which related information is recalled together (Williams & Hollan, 1981). To provide another example more germane to the study at hand, direct retrieval of names from an individual's Facebook might stem from the cue "who did I last message," whereas indirect retrieval would involve the generation of names from various contexts (e.g., classes, family, colleagues).

Research has recently highlighted the importance of working memory capacity (WMC) in effective memory search for remote episodic (Unsworth, 2007), semantic (Rosen & Engle, 1997), and autobiographical memories (Unsworth et al., 2012). Unsworth and colleagues (2012) showed that individuals with a high-WMC were better able to retrieve information from their autobiographical knowledge base than were low-WMC individuals, as demonstrated by their ability to recall more friends, more clusters of friends (contexts), greater cluster size and an increased speed with which this reporting

[1] Grouping of items of a similar nature together when recalling information.

was achieved. Another study that used a semantic fluency task found that high-WMC individuals were better able to generate contexts (e.g., farms, jungles, forests and so on) than were low-WMC individuals (Rosen & Engle, 1997). Furthermore, previous work has shown that in healthy adults both switching and clustering are key aspects of performance for on phonemic and semantic fluency, in which switching is associated with better phonemic fluency scores, but that both switching and clustering are associated with semantic fluency (Troyer, Moscovitch, & Winocur, 1997). Taken together, these studies highlight the importance of context-generation, switching, and clustering in the strategic search of memory. Moreover, individuals with high-WMC are more effective when searching their memory bank for episodic, semantic and autobiographical information (Unsworth, 2007; Unsworth et al., 2012). It is possible that other variables such as mood impact search effectiveness.

Notably, there are reports of working memory deficits in MDD (Christopher & MacDonald, 2005) and in individuals with dysphoria (e.g., Williams et al., 2007). One study showed that the primary deficit in WMC in depressed individuals might be the updating process (Harvey et al., 2004). The same study showed that set shifting and inhibition processes are also impaired on working memory tasks. Yet another study showed depressed individuals experienced more intrusions during a working memory task compared to controls for both that was especially pronounced for negatively valenced information (Joorman & Gotlib, 2008). In this context, low WMC might serve as a potential avenue for OGM. That is, if low WMC is characterized by difficulties updating information and set shifting, along with a reduced ability to resist intrusions, it stands to reason that the ability to search through memory and retrieve an event that is specific in time, location, and place would be impaired, and thus overgeneral. The goal of the present experiment is to determine whether dysphoric individuals search their memory in a qualitatively or quantitatively different way than non-dysphoric individuals. Related, the present study will also explore the extent to which any relations between search and dysphoria are independent and/or mediated by WMC.

Method

Participants

The participants in this study are a subsample of those who participated in Study 2, above (N = 56; 33 non-dysphoric, 23 dysphoric). Participants were enrolled in a first year Psychology course at Ryerson University, and recruited through the Sona system. All participants were between 18 and 55 years of age, and identified English as their primary language, or that they learned English before 5 years of age. Exclusion criteria included a history of a neurological condition, or a loss of consciousness for more than 30 minutes.

Participant characteristics. Table 6 displays the demographic characteristics of the sample. There were significantly more females than males in the sample, $\chi^2(1, N = 56) = 28.57$, $p < .001$, but the groups did not differ in their sex distribution, *ps* > .05. There was no difference between groups on age. Full-scale IQ scores were estimated using the Matrix Reasoning and Information subscales of the WAIS-III; no group differences were detected. Similarly, there were no differences in verbal fluency between the groups, as measured by the COWAT.

Significant differences were observed for clinical characteristics: the dysphoric group had higher total DASS-21 scores, $t(54) = 5.68$, $p < .001$, as well as on all the subscales, depression, $t(54) = 11.16$, $p < .001$, anxiety $t(54) = 2.97$, $p < .01$, and stress, *t*(54) = 2.78, *p* = .01. The dysphoric group scored in the moderate range for all the subscales of the DASS-21, whereas the non-dysphoric group scored in the normal range. Similarly, differences were observed on the PAS, *t*(54) = 2.86, $p < .05$, and the PIM, *t*(54) = 2.35, $p < .05$, and NIM scales of the PAI, *t*(54) = 2.64, $p < .05$. The dysphoric group scored in the moderate range for the total PAS score, whereas the non-dysphoric group scored in the normal range. On the NIM subscale, the dysphoric group scored in the mild range whereas the non-dysphoric group scored in the normal range. Despite a statistical difference between the groups on the PIM subscale, both groups scored in the same range (normal). There were no statistically significant differences on the DRG or ALC subscales of the PAI.

Procedure

Working Memory Capacity

Participants in Unsworth et al.'s (2012) study were organized into groups based on a composite of *z*-transformed working memory scores on three separate tests: reading span, operation span, and symmetry span, in which participants were assigned to high WMC if their composite scores were in the top quartile, and assigned to low WMC if their composite scores were in the bottom quartile. For logistical reasons and the differential focus of the current study, only the reading span test (RSPAN) was used as it is thought to be the best predictor of overall WMC (Daneman & Carpenter, 1980; Unsworth, personal communication, 2013).

Reading span. Participants first completed a computerized reading span (RSPAN) test of WMC. In this task, participants were required to read sentences and determine whether the sentence made sense. Half of the sentences made sense (e.g., “After the test, we were completely exhausted”), whereas the other half did not make sense (e.g., “After the test, we were completely spaghetti”). After judging whether the sentences made sense, participants were presented with a letter for 1 second. The sentence judgment aspect of this task contained between 3 and 7 trials. When prompted, participants were asked to recall, in order, the letters that followed the sentences. The variables of interest here were absolute performance, total correct responses, reading errors, speed errors, and accuracy. Absolute performance is the sum of trials in which all letters (e.g., target stimuli between sentence judgments) were recalled in correct sequence, plus performance on the judgment of whether sentences made sense. Total correct responses are the total number of correctly recalled letters (e.g., participants could score between 0 and 7 on each ‘round’). Reading errors are the number of times that participants judged a nonsensical sentence to as making sense, plus the number of times they judged a coherent sentence as nonsensical. Speed errors are the number of times that participants did not respond within their average time range on the test trails; this was included as a measure to reduce the chances that waning attention may have had on the results, and is in line with previous work (e.g., Unsworth et al., 2012). Accuracy was a measure of correct responses, reading errors, and speed errors.

Memory Search Performance

Following Unsworth et al. (2012), we examined several areas of strategic memory search. In order to examine this, I followed the procedure outlined by Unsworth et al. (2012) by using a Facebook memory search method. In this task, participants were instructed to recall as many of their friends on their Facebook friends list as possible. They were given

8 minutes, and informed that they could recall the names in any order. The participants typed each name into an Excel file. Following the 8 minutes of recall, participants were provided with their output and asked to categorize each response based on where/how they knew each person. The categories included elementary school, high school, college/university, family, friends, work, romantic, club/team and random. Participants were encouraged to indicate if any name belonged to more than one category. Furthermore, participants were asked to provide a description of how they met as many of the people as possible. This aspect of the task did not have a time limit. Finally, participants were asked to provide ratings of closeness to each name recalled, from 1 (not close) to 7 (very close). I also had participants estimate how much time they spend on Facebook on average, and we asked them to log in to Facebook to verify the total number of friends on their Facebook profile, in order to examine whether these characteristics affected search-related performance. The dependent variables we examined were the number of names recalled, number of clusters, cluster size, and non-clustered recall.

Data Analysis

Before data analysis, all data were checked for entry errors, missing values, outliers, and examined for violations in parametric assumptions. One participant refused audio recording of their interview, and were excluded from data analysis. The analyses were conducted on a total of 56 participants. All analyses were completed using SPSS version 21. Alpha was set to .05, unless stated otherwise.

Results

Working Memory Capacity

Scores on the RSPAN were *z*-transformed and visually examined and appeared normally distributed. Indeed, *t*-tests indicated no group differences on any measures of WMC including absolute performance, total correct responses, reading errors, speed errors, and accuracy (all *t*s < 1.0). Both groups fell within the average range for WMC (see Table 7).

Memory Search Performance

To examine the memory search performance variables, we conducted a series of *t*-tests on the number of names recalled, number of clusters, cluster size, and non-clustered recall. Of note, the dysphoric group demonstrated a higher degree of non-clustered recall, $t(54) = 2.70$, $p < .01$. Importantly, this higher score is suggestive of a *less* organized search strategy, and might be indicative of a memory search that is prone to other 'intrusive' search traces. Essentially, non-clustered recall refers to the recall of names that are not categorically related (e.g., grandfather's name "intrudes" into list of high school friends). There were no group differences on the amount of time spent on Facebook or on the total number of friends on participants' Facebook profiles (see Table 8).

Regression and Mediation Analysis

To assess the relation between dysphoria and disorganized retrieval, and the potential mediation by absolute WMC, DASS-21depression scores were regressed on non-clustered recall; a significant relation was observed, $F\,(1, 54) = 5.32$, $p < .05$, indicating that the predictor was correlated with the outcome (Baron & Kenny, 1986). Next, I regressed absolute WMC on DASS-21 scores and obtained a significant finding $F\,(1, 54) = 7.93$, $p < .01$, showing that the predictor was correlated with the mediator.

Finally, I conducted a simple linear regression, with non-clustered recall as the dependent variable, and DASS-21 depression scores and absolute WMC as the independent variables (see Table 9). Here, the results showed that absolute WMC was not significantly correlated with non-clustered recalled in a statistically significant way. As Table 9 outlines, DASS-21 depression scores alone significantly predict non-clustered recall performance, in that higher depression scores predict greater non-clustered recall, which is indicative of a *worse* search strategy. When absolute WMC is added to the regression, the amount of variance explained by DASS-21 depression scores increased slightly. Absolute WMC did not predict non-clustered recall performance on its own. Thus, the relation between DASS-21 depression scores and non-clustered recall performance was not mediated by WMC (see Figure 7).

Discussion

The objective of the present study was to test whether individuals with mood related symptoms search their memory differently than individuals without mood symptoms. The motivation behind this study was based on the assumption that OGM could emerge at any stage of memory processing from pre-retrieval, monitoring, control to output. Furthermore, poor WMC could offer another potential account for OGM. In order to isolate performance at the pre-retrieval stage, I employed a semantic AM search task that had previously been used to demonstrate the role of WMC in AM performance (Unsworth et al., 2012). The data collected here point toward two relevant findings. First, dysphoric individuals engage in memory search strategies that may be less organized than non-dysphoric participants, as exhibited by the increased number of non-clustered names. More specifically, dysphoric individuals exhibited a tendency to be more disorganized in their memory search as illustrated by the finding that they recalled a more non-clustered information (names of friends on Facebook) than non-dysphoric participants. In other words, dysphoric participants had more randomness and/or intrusions in their search strategies than non-dysphoric participants. The second important finding was that, in contrast to previous work (Unsworth et al., 2012), WMC did not mediate search performance, but rather, the decreased performance in the dysphoric group was mostly attributable to their mood symptoms. Indeed, the groups did not differ significantly on absolute measures of WMC, but the strategic component of *using* working memory was impaired as a result of worse mood symptoms.

Hypothesis 1 of the present study was that dysphoric individuals would mirror the performance of low-WMC individuals reported by Unsworth et al. (2012) as exhibited by generating fewer names, fewer contexts, smaller clusters, and increased non-clustered information. This hypothesis was only partially supported, in that performance was equivalent between groups on all measures with the exception of a specific mood-related deficit in non-clustered recall. Although depressive symptoms were associated with worse WMC, WMC did not mediate performance on non-clustered recall. In line with Unsworth et al. (2012), Hypothesis 2 was that memory search strategy would be mediated by WMC. The data did not support this hypothesis, but it serves to further highlight the importance of low mood in the context of strategic memory use. That is, the dysphoric group did not perform worse on this task because their WMC was lower than the non-dysphoric group but rather because of their mood-related symptoms.

According to Koriat and colleagues (Koriat, Goldsmith, & Halamish, 2008), the search phase of memory processing is an automatic stage that begins with four pre-retrieval decisions: monitor familiarity/accessibility, engage or forgo a search, set search strategies, and set retrieval cues. The present study concerned itself with search strategies, which are initiated only after an individual has decided to engage in searching their memory. This distinction is important because individuals are capable of "remembering" something without having to search their memory. For example, if someone were to ask you if your cell phone from 1999 was capable of wirelessly connecting to the internet, you would not necessarily have to search your AM for this information, rather you could infer based on your knowledge of technology (e.g., semantic memory) that wireless internet access was not available on cell phones until relatively recently and answer with "no." However, if the semantic knowledge about cell phone technology was an unfamiliar topic, you could begin the processes of searching your AM in a number of effortful ways including, for example, trying to recollect all the cell phones you have owned. Thus, only after deciding that a memory search is necessary does the effortful metamnemonic process of search strategy begin (Koriat et al., 2008). Although there are numerous search strategies, some are more effective than others. One strategy posited by the generate-recognize model (Bahrick, 1969) is to generate contexts where the relevant information may be housed. In the present experiment, relevant contexts included family members, friends, colleagues, peers, acquaintances (and subdivisions). Thus, an effective memory strategy in the present task would be to generate each context, recall as many names as possible, and then generate a new context and so forth. This strategy allows the rememberer to search in an organized rather than a haphazard and pseudo-random manner. The generate-recognize method of search is not always optimal, however. For a number of search opportunities, direct retrieval is more effective (as in the cell phone example above). It would be a waste of cognitive resources to try and recollect the exact cell phone you had in 1999 along with trying to remember its technological capabilities to answer such an inane question. Similarly, it does not require much effort to recall your immediate family members' names; that is, you would not necessarily need to first think about your mother as a category of parent in order to recall her name. Presumably, you would just know that because it is so easily accessible. Direct retrieval is considered to be nearly effortless, whereas the generate-recognize is an effortful process. In the context of the present results, it appears that the effortful component of memory search/strategy use was impaired in dysphoric compared to non-dysphoric individuals. Indeed, research has found that there are deficits in effortful cognitive processes in depressed individuals (Hartlage et al., 1993), and the present results extend that finding to show that deficits exist at the pre-retrieval stage of metamnemonic use. One recent study using the AI showed that although retrieval cues improved episodic detail recollection in individuals with MDD, they were still impaired relative to healthy controls, consistent with the possibility that the deficits in recollection occur at least partly at the pre-retrieval stage (Söderlund et al., 2014). The fact that this study found that performance did increase to a small degree with the aid of retrieval cues, however, also suggests that there may be some deficits associated with the post-retrieval stages of memory use in MDD.

It stands to reason that if dysphoric individuals are less effective at effortful metamnemonic processes at the pre-retrieval stage that it may have an impact "downstream" on AM performance, and could account for at least a component of, or manifest as OGM. As proposed by Koriat et al.'s (2008) Controlled Retrieval Model, pre-retrieval memory processes include the decision to initiate or forgo a memory search, select a search strategy, and to select retrieval probes. Here, the search strategy to group names together may be an either implicit or explicit decision. Either way, it is happening in the pre-retrieval stages of Koriat et al.'s (2008) model. Of course, it is also reasonable to hypothesize that the output order of names was determined during the post-retrieval stage, but the preset study attempted to minimize the role of post-retrieval strategies by not providing explicit instructions on how to categorize names until *after* the recollection had occurred. AM retrieval entails a highly demanding and effortful set of cognitive operations that rely heavily on executive function (Burgess & Shallice, 1996b; Conway & Fthenaki, 2000). The results from the present study suggest that in the pre-retrieval stages of memory use, dysphoric individuals are at a disadvantage compared to non-dysphoric individuals as evidence by having more random intrusions into memory, and ultimately a less organized memory search. With these pre-retrieval operations as a starting point in the memory retrieval process, individuals with mood symptoms appear to be at a disadvantage, which may easily compound and potentially tax cognitive resources to a greater degree, limiting the effectiveness of the remaining operations. Another potential explanation for the impaired indirect retrieval observed in the present study is the functional avoidance component of the CaR-FA-X model (Williams et al., 2007). More specifically, the negative affect that might be associated with other memory traces, or generated during indirect memory retrieval, might cause a depressed individual to terminate the search operation prematurely in order to minimize the impact of the negative affect. The data from the present study cannot determine whether this is indeed the case, but it seems like a plausible, and testable, hypothesis.

Despite the differences observed in non-clustered recall, the overall performance (e.g., output) between groups in the present study was not significantly different. However, disorganized recall is likely of functional relevance for individuals with mood-related symptoms. For example, in trying to recall items on a grocery list, a disorganized strategy may result in fewer items being recalled. Although forgetting an item at the grocery store is hardly of consequence for individuals without mood-related symptoms, depressed individuals exhibit a significant degree of negative self-talk and cognitive distortions (e.g., Beck et al., 1979) in which small events may be seen as patterns of never-ending failure (Burns, 1999). When combined with the tendency to ruminate over negative events, the impact of negative talk about oneself can have a significant detrimental effect on one's mood. Indeed, this notion is central to CBT (Beck et al., 1979). Thus, difficulties with using memory may be one of the issues that maintains low mood.

The present study has several limitations. First, for logistical and pragmatic reasons, I decided against testing clinically diagnosed individuals with MDD, which would have served as a more representative test of true OGM search. Although OGM is most often reported in MDD, it has been reported, to a smaller magnitude, in dysphoric individuals. There were several benefits of using a sample of dysphoric individuals, which included having fewer confounds on cognitive or demographic variables. Further, using a dysphoric analogue sample allowed for the recruitment of a much larger sample that ultimately allowed for the detection of some important differences between individuals with subthreshold mood symptoms and those without. That is, the present study found some promising results in a sample of sub-clinically depressed individuals, and serves as a proof-of-principle that may warrant a future study with a more clinically representative sample. Second, only one of the cognitive operations under the umbrella of the pre-retrieval stage of memory processing was investigated. In order to be able to fully characterize the ways in which pre-retrieval operations are implicated in poor memory performance it would be necessary to test all aspects including monitoring familiarity/accessibility, engaging or forgoing a search, setting search strategies, and setting retrieval cues (Koriat et al., 2008). Again, the present study was concerned with one aspect of this model, and obtained positive results that motivate future studies investigating the remaining processes at pre-retrieval. A further limitation was that, due to a technical error, we were unable to address the recall latency as reported by Unsworth et al. (2012). Briefly, Unsworth et al. (2012) showed that low-WMC individuals exhibited a decreased recall rate over the duration of the recall span, and that this pattern was most prominent in the first minute of the task. Without this information, I was unable to address this component of memory search, which would have added more explanatory value to the study. Finally, rather than taking a composite of WMC as other authors have done in previous studies (e.g., Unsworth et al., 2012) by using performance on operation span, symmetry span, and reading span to create an overall index of WMC, I only used reading span as a measure of WMC. Reading span, however, is the best predictor of WMC (Daneman & Carpenter, 1980; Unsworth, personal communication, 2013). By excluding operation and symmetry span, it may have limited the comprehensive assessment of WMC as a potential mediator of depression-related impairment in the disorganized search processes observed. However, others using all three measures obtained similar results (Hubbard et al., 2016).

Table 6
Demographic and Cognitive Characteristics of the Participants

	Non-dysphoric *n* = 33		Dysphoric *n* = 23	
Demographic Data				
Male/Female	5 / 28		3 / 20	
	M	*SD*	*M*	*SD*
Age	19.24	1.83	21.26	7.97
Cognitive Performance				
WAIS Info*	11.70	2.19	12.52	1.86
WAIS Matrix*	10.24	2.15	10.74	1.71
COWAT**	41.00	11.06	37.74	13.33
Clinical Characteristics				
PAI PAS [t]	39.92	24.45	59.85	27.28
PAI ALC	46.70	7.43	50.08	7.48
PAI DRG	48.24	10.07	48.69	7.76
PAI PIM [t]	41.45	9.33	35.61	8.87
PAI NIM [t]	49.82	5.99	55.52	10.16
DASS-21 Depression [ttt]	3.88	2.28	16.09	5.67
DASS-21 Anxiety [tt]	6.12	4.74	11.13	7.86
DASS-21 Stress [tt]	13.03	8.23	19.39	8.69

* Standard scores ** Raw scores

[t] Significant at $p < .05$; [tt] Significant at $p < .01$; [ttt] Significant at $p < .001$

Table 7

	WMC Measure				
Group	*Absolute*	*Correct*	*Reading errors*	*Speed errors*	*Accuracy*
Non-dysphoric	34.30 (16.47)	52.88 (12.99)	5.94 (4.26)	1.79 (2.69)	4.15 (2.69)
Dysphoric	29.17 (14.31)	50.61 (13.05)	8.09 (15.10)	4.13 (15.50)	3.96 (3.86)

Table 8

	Search Performance					
Group	*No. recalled*	*Total clusters*	*Cluster size*	*Non-clustered recall*	*Total friends*	*Time on Facebook*
Non-dysphoric	51.70 (18.11)	10.79 (4.23)	4.31 (1.26)	6.48 (2.50)*	378.42 (310.92)	7.80 (12.11)
Dysphoric	52.43 (19.18)	10.65 (4.26)	4.05 (1.10)	9.09 (4.68)*	425.48 (338.44)	6.13 (6.33)

* Significant at .05

Table 9 *Mediation analysis of working memory capacity with non-clustered recall as the DV*

	Simple regression		
	B	SE B	β
Step 1			
Constant	6.14	0.77	
DASS-21 depression	0.15	0.07	.29*
Step 2			
Constant	4.64	1.50	
DASS-21 depression	0.18	0.07	.35*
Absolute WMC	0.04	0.03	.16

Note: $R^2 = .09$ for Step 1 (DASS-21 depression), $R^2 = .11$ for Step 2 (DASS-21 depression, Absolute WMC)

* $p < .05$

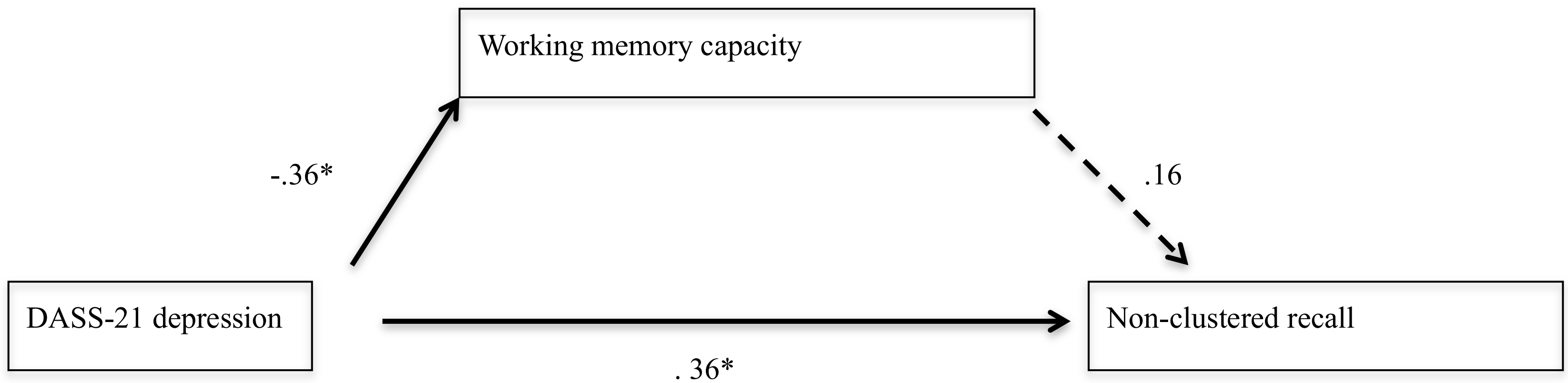

Figure 7. Standardized regression coefficients for the relation between DASS-21 depression scores and non-clustered recall scores is not mediated by working memory capacity (Absolute WMC). The results here indicated that depression scores are independently predicting lower WMC and greater non-clustered recall. See Table 9 for further details.

CHAPTER 5: Integration and General Discussion

The collection of studies in this dissertation investigated several metamnemonic components of strategic memory use in the context of real life autobiographical events and laboratory-based stimuli in dysphoric and non-dysphoric individuals. One of the primary motivating factors for the present studies was to examine the phenomenon of OGM, which has been commonly reported in depressed individuals (e.g., Brewin et al., 1999; King et al., 2010; Williams & Broadbent, 1986), and has been linked with symptom severity (Brittlebank et al., 1993) and the likelihood of potential future depressive episodes (Peeters, Wessel, Merckelbach, & Boon-Vermeeren, 2002). Rather than investigate AM through typical AM measures (e.g., AI, AMT), the present series of studies has conceptualized AM as a component of event memory performance in general, and specifically proposed that meta-mnemonic processes and principles might offer explanatory accounts of depression-related OGM. That is, the present dissertation suggests that OGM may not be a standalone or unique phenomenon centering on AM (e.g., Burnside et al., 2004; Kuyken & Howell, 2000); rather the theory pursued here is that poor AM performance is the result of poor memory abilities for events in general exhibited by a quicker rate of memory decay/forgetting that results in strategic decisions about how to use memory to compensate for general impairment (e.g., larger grain size – i.e., less detail for given memories) or are confounded by other meta-mnemonic deficits (e.g., poor search strategies).

The three experiments in this dissertation were divided into two broad categories: metamnemonic principles/processes, and basic memory processes. I used Goldsmith and Koriat's (2007) QAP methodology to investigate two aspects of metamemory: whether dysphoric individuals regulate their memory output in terms of balancing accuracy and informativeness similarly to non-dysphoric comparison participants, and to examine any differences in criterion setting between these groups. Contrary to my hypotheses, there were no statistically significant group differences across QAP variables, pointing to spared metamemory operations in dysphoric individuals. In a separate study, I investigated memory organization and search operations for autobiographically relevant information. In this study, participants were required to search their memory and output as many friends' names as they could remember in an eight-minute span. The results of this study showed that dysphoric individuals appear to search their memory in a less efficient way than non-dysphoric participants, as exhibited by their more frequent organizational cluster shifting. More specifically, non-dysphoric participants appeared to be better at identifying an organizing structure in their recollection so that they would, for example, recall sequentially family members, high school friends, and university friends sequentially, while volunteering relatively few out-of-cluster names. By contrast, the dysphoric group was much more likely to have seemingly random intrusion of names into a cluster, which caused them to switch set more often, and is indicative of less organized search operations (e.g., Unsworth et al., 2012). However, contrary to expectations, these findings were not mediated by WMC. Thus, findings in this study support my hypothesis that dysphoric individuals may search their memory in a qualitatively different way than non-dysphoric comparison participants.

Finally, I also examined the impact of a delay period for both autobiographical events and a short story. Here, the delay period clearly impacted the dysphoric group to a much greater extent than the non-dysphoric group on both memory tasks. Critically, both groups were matched for performance variables upon immediate recall, such that both groups reported the same number of details, reported equal levels of confidence, and reported re-experiencing the same level of qualitative perceptual/experiential aspects of the events. After a delay, however, the dysphoric group exhibited significantly worse recollection than the non-dysphoric group, as exhibited by recalling fewer internal (episodic) details on both autobiographical events and the short stories. Although both groups performed worse after a delay, the dysphoric group appeared to be impacted to a greater extent. At immediate recall, groups did not differ in their overall confidence in their responses for either memory task. At delayed recall, however, the dysphoric group had less confidence in their correct responses than did the non-dysphoric group on the EMT.

Integration with Current Theories of AM, Memory and Metamemory

The results of this dissertation support some of, but not all, the claims of the SMS proposed by Conway and colleagues (Conway, 2005; Conway & Pleydell-Pearce, 2000) and the CaR-FA-X model proposed by Williams and colleagues (Williams et al., 2007). Each of these models will be explored in turn.

The self-memory system. First, the SMS is best conceptualized as a storehouse of information about oneself that operates via the two theoretical structures/processes called the AM knowledge base and the working self (Conway, 2005; Conway & Pleydell-Pearce, 2000). As a reminder, the working self is part of Baddeley's (1986) working memory system that serves to orient and update memory users as they move towards accomplishing a given goal that is personally relevant. The AM knowledge base is an organizational structure that divides an individual's life into three levels: the superordinate category of lifetime periods, that has general events embedded within it, and finally event-specific knowledge that is embedded within general events (see Figure 1). According to Conway and colleagues, OGM is the result of an ineffective memory search, whereby depressed individuals abort their search at the General Events level rather than continuing through to the Event-Specific Knowledge level (Conway & Pleydell-Pearce, 2000). This search must go from the broadest level of the AM knowledge base through to the narrowest level to obtain a unique event, and it requires effortful processing and an adequate amount of resources from the working self (working memory). Depressed individuals, then, are thought to have fewer cognitive resources to dedicate to the effortful memory search, ultimately resulting in terminated search processes at the General Events level. Indeed, research has shown that individuals with MDD have impaired working memory (Channon, Baker, & Robertson, 1993; Christopher & MacDonald, 2005; Hartlage et al., 1993). Some studies have shown that working memory impairments in MDD are specific to Baddeley's (1996) central executive (Channon et al., 1993; Hartlage et al., 1993), whereas other work has shown that working memory impairments also affect Baddeley's (1996) phonological loop and visuospatial sketch pad (Christopher & MacDonald, 2005).

In the series of experiments presented in this dissertation, the results of Study 3 (chapter 4) showed that WMC is spared in dysphoric individuals, as their performance was equivalent to the non-dysphoric group. This contrasts with other work showing deficits in WMC in dysphoric individuals as exhibited by greater latencies when responding to negative stimuli (e.g., Joorman, 2004). Joorman (2004), however, also showed that the WMC deficits were only observed for negative material. The results from Study 3 here did not employ a valence manipulation, and it could be reasonably hypothesized that the material was neutral to positive (recall of friends), which is in line with Joorman's (2004) findings of preserved WMC for neutral and positive information. Similarly, recent work using very similar methodology as was employed in Study 3 has shown that dysphoric individuals exhibited impaired WMC only when negative information was embedded into a WMC task; when neutral or positive information was embedded, there were no group differences on WMC (Hubbard et al., 2016). Despite this lack of group differences on WMC, the dysphoric group did exhibit a semi dysfunctional search strategy that was characterized by more intrusions. Given that WM deficits are more robust in MDD compared to dysphoria (Joorman & Gotlib, 2008; Levens & Gotlib, 2010), memory search strategies may also be more disorganized in MDD. Based on the data from Study 3, this suggestion is partially supported by the association between increasing DASS-21 scores and worse WMC (even though there were no statistical group differences). Although no experimental measure was included to examine Baddeley's (1996) central executive per se, it is plausible that the results obtained in chapter 4 speak to this aspect of working memory, as the central executive is theorized to oversee and control the cognitive operations, and make decisions regarding retrieval strategies. It follows that if the dysphoric group recalled more non-clustered items, that their central executive may be particularly affected.

The presence of intrusive items on the AM recall task meshes with the role that rumination plays in depression (Nolen-Hoeksema, Morrow, & Fredrickson, 1993). Briefly, rumination is the tendency often reported in depression in which individuals repeatedly think about the causes of negative affect (Nolen-Hoeksema, 1991). Research has routinely demonstrated that the presence of rumination in depression is associated with a host of negative clinical outcomes, including increased severity of depressive symptoms (Nolen-Hoeksema & Larson, 1999), and future depressive episodes (Just & Alloy, 1997). Increased rumination has also been associated with OGM in dysphoric (Romero, Vazquez, & Sanchez, 2014) and depressed individuals (Watkins & Teasdale, 2001). One of the potential mechanisms for OGM offered from the results of Study 3 (chapter 4) is that working memory may be more prone to intrusive/unrelated material that may serve to derail the optimal retrieval strategy. To further investigate this claim, a more acutely depressed sample would be required, and clear measures of rumination would be necessary. Study 3 (chapter 4) did not include a measure of rumination, and it precludes a firm conclusion regarding how rumination may relate to aberrant search strategies, but given the known impact of rumination on cognitive resources (e.g., Watkins & Teasdale, 2001), it seems like a plausible explanation.

Rumination appears to be a cognitive symptom that is resistant to intervention. One recent investigation trained highly ruminative participants on an n-back working memory paradigm over a period of six days (Onraedt & Koster, 2014). The results showed that participants' performance on the n-back improved with training, but that the results did not generalize to "real-world" working memory, in that trained participants were no more able to expel emotional information from their working memory than untrained participants. Here, it appears that rumination remains a constant drain on working memory performance, even after a short period of training. In Study 3, the task used to examine AM search strategies required participants to recall as many Facebook friends' names as possible. The value in using Facebook is that it is an ecologically valid way of examining relevant semantic autobiographical information that is unique to each participant. Rather than relying on a laboratory-based task, Facebook allowed for participants' idiosyncratic experiences to be captured in their memory search operations, which is a better proxy for real-life memory. This study found that dysphoric individuals exhibited a disorganized search strategy when compared to non-dysphoric individuals; one possible explanation for the dysfunctional search strategy in the dysphoric group may have been that certain names may have triggered an emotional response (positive or negative) that then acted to distract them and disrupt an organized search strategy. From an ecological perspective, the difficulty in conducting an organized search strategy may cause, at best, minor memory failures such as forgetting to pick up given items at the grocery store on an impromptu outing, or at worst, impact an individual's ability to relay important information about their own experiences that serve to create and maintain social bonds (e.g., Walker et al., 2009). Broadly speaking, the most common outcome of impaired search strategy is likely somewhere between these two hypothetical examples.

Study 2 (Chapter 3) used the same participant sample as Study 3 (Chapter 4), and it offers a chance to address the role that WMC plays in OGM. At Time 1 in Study 2, performance on the EMT and the AI were indistinguishable, which was contrary to my hypothesis; nonetheless, it indicates that OGM is not just a general response style associated with dysphoria. At Time 2, however, significant differences were observed in which the dysphoric group performed worse on both measures of memory, suggestive of a faster decay rate than the non-dysphoric group. Given that memory deficits appear to be more pronounced after a delay period in MDD (Ilsley, Moffoot, & O'Carroll. 1995), it is possible that the ability of the dysphoric group to search sequential stages of the AM knowledge base became more effortful over time, leading to impaired performance after a delay. Another theoretical alternative to a steeper rate of memory decay, although not directly addressed in this series of studies, is retroactive interference (e.g., Melton & von Lackum, 1940; Underwood, 1957). Retroactive interference is when newly learned information inhibits the recollection of previously learned material (Underwood, 1957). Given that the sample used in these studies were undergraduates, participants would have been required to learn new material through their course work between testing sessions. It is plausible that this new learning had a disproportionate impact on dysphoric participants. If events are not distinct enough, they become harder to truly recollect; indeed, if newly encoded material is similar to what was encoded previously, it may be more susceptible to retroactive or proactive interference in dysphoric individuals. According to the SMS, all new events are on a forgetting trajectory that will ultimately be largely forgotten unless the new events are integrated within the AM knowledge base (e.g., semantic facts about oneself; Conway, 2005). The results from Study 2 then would be due to participants' not making a connection between their experience in the laboratory, or throughout the following period, to their broad AM knowledge base.

Recent research has demonstrated that individuals with depressive symptoms were impaired on an experimental measure of pattern separation relative to individuals with no depressive symptoms (Shelton & Kirwan, 2013). Pattern separation is a process whereby similar representations (events, people, places etc.,) are stored as distinct "nodes" (Yassa & Stark, 2011). As an example, one might have a neural representation of a Santa Claus; pattern separation ensures that we do not generalize every bearded man in red as Santa.

This process has been argued to be a key feature of episodic memory (e.g., Norman & O'Reilly, 2003). To return to the results from Study 2 (Chapter 3), it is possible that the overlap between a "typical" day of undergraduate education was more difficult to distinguish from another for the dysphoric group. The same can be said for the short stories on the EMT, both of which were filled with a variety quantitative information (upwards of 150 unique informational bits), even though both groups were matched at immediate testing. OGM in depressed individuals would be a natural and logical consequence of impaired pattern separation. This is an enticing proposition that has yet to receive much attention (but see Shelton & Kirwan, 2013).

One other potential account of the data may be that dysphoric participants imposed less organizational structure on the information they learned at encoding on the EMT, or on autobiographical experiences in general. Although this explanation seems possible, it does not fit completely with the data from Study 2 in that both groups were match for performance on the AI and the EMT at immediate testing, which suggests at least some organizational structure at encoding. The data cannot speak directly to this interpretation, so this is purely speculative in nature. A more thorough investigation of memory organization would be required to make any firm conclusions.

The results of Study 1 (Chapter 2) cannot be integrated into Conway's (2005) SMS, because the model emphasizes search and retrieval operations and makes no explicit claims regarding how information is volunteered. It might be worthwhile to consider expanding the SMS to include additional metamnemonic processes such as monitoring and control. One might reasonably hypothesize that both monitoring and control operations would happen concurrently at the General Events level, or perhaps at the

Event Specific Knowledge level. Next, I turn to Williams et al. (2007) CaR-FA-X model to explain the results from the series of studies presented in this dissertation.

Capture and rumination, functional avoidance, and impaired executive function model. Broadly speaking, three keys findings emerged from the studies presented in this dissertation: preserved monitoring, calibration, and resolution in dysphoric individuals (Study 1, Chapter 2), preserved episodic and AM at immediate testing but impairments in both domains after a delay in dysphoric individuals (Study 2, Chapter 3), and impaired search strategies in dysphoric individuals (Study 3, Chapter 4). These results will be explored in turn in the context of the CaR-FA-X model (Williams et al., 2007).

The cognitive deficits associated with MDD are known to vary with symptom severity such that greater impairments are associated with greater depressive symptoms (or vice versa; e.g., McDermott & Ebmeier, 2009). Although executive function deficits are commonly reported in depressed individuals (2009; Trivedi & Greer, 2014), less is known about dysphoric populations, but it stands to reason that dysphoric individuals would have less cognitive impairments than individuals with a diagnosis of MDD. In Goldsmith and Koriat's framework (2008), the act of monitoring one's memory operations is thought of as a taxing cognitive operation, reliant on intact executive functioning. One measure used in this study to directly tap executive functioning was the COWAT, and the results showed that groups were matched on this variable in Studies 1 and 3; similarly, both groups were matched for overall WMC and for performance on the Matrix Reasoning subtest of the WAIS-III. If OGM is in part due to impaired executive function deficits as the CaR-FA-X model posits, it may be the case that the null findings with respect to monitoring, calibration, and resolution in Study 1 are the result of using a subclinical sample rather than individuals diagnosed with MDD through a structured interview. That is, the executive deficits may be too mild to have had an effect on the dysphoric group's ability to engage in effective monitoring, calibration and resolution. There are two logical follow-ups to this investigation, the first of which is to recruit a more acutely depressed sample. The second of which is to examine performance on the QAP after a delay in either a dysphoric sample, or a depressed sample. Indeed, the fact that judgments of learning (JOLs) are quite accurate at immediate recall, but poor at delayed recall in healthy controls suggests that a delay period can have an effect on metamemory (Koriat, Bjork, Sheffer, & Bar, 2004; but see Kimball & Metcalfe, 2003). In Study 2 of this dissertation, the results clearly showed that a delay period had a disproportionate impact on the dysphoric group's recollection of autobiographical, and laboratory events. In Williams et al. (2007) model, impaired executive function is thought to play a critical role in OGM, and in the present series of studies, executive deficits were not observed which may have accounted for the null findings between groups regarding metamnemonic processes in Study 1. However Study 2 revealed OGM accompanying dysphoria, as indexed by the lack of episodic details for both tasks after a delay period. Of note, this expression of OGM can just as easily be interpreted as a reflection of poor memory, in general, without necessarily evoking elements of the CaR-FA-X model.

The results of Study 2 that showed impaired episodic and AM after a delay are more difficult to explain using the CaR-FA-X model, so the following section is speculative in nature. Functional avoidance is the tendency observed in PTSD and MDD to avoid recollecting distressing memories; from a behavioural perspective, it is negatively reinforcing to ignore/suppress/neutralize negative or distressing memories. Although the AMs recalled in Study 2 were considered neutral, as were the short stories, it is possible that the functional avoidance of negative memories begins to permeate not distressing memories, but all event memories in general. That is, over time, one loses the skill to report specific instances because it becomes reinforcing to stop the recollection process prematurely, as in Conway's (2005) SMS. Indeed, Williams et al. (2007) propose that this may be the case in individuals that have been through repeated episodes of depression. The studies in this dissertation did not screen past depression, and instead focused on current levels of depressive symptomatology; thus, it is possible that some of the participants in either group had histories of depression or trauma, and this may have minimized the sensitivity of the data in this context. The samples used in this dissertation are unlikely candidates for chronic depression due to their young age, but it is possible that even subthreshold depressive symptoms set the functional avoidance cycle into practice. Nonetheless, only examining current depressive symptoms precludes the ability of the present studies to comment on the notion that OGM may be a trait marker associated with depression; the present studies can only address OGM in relation to emotional state.

Similar to the above discussion on the SMS and rumination, the same logical applies in the CaR-FA-X model and may be able to account for the dysfunctional search strategy employed by the dysphoric group in Study 3, in which they were more likely to recall semantic autobiographical information out of set. According to the CaR-FA-X model, the early stages of memory retrieval rely on idiosyncratic ways of processing information, which can be affected by an individual's schemas (Beck, 1976). Schemas are known to impact the processing of information, especially for emotional material, often referred to as mood congruent informational processing (Christensen & King, 2013), which has been reported in dysphoric individuals (Koster, Raedt, Leyman, & Lissnyder, 2010), individuals with MDD, and individuals without psychiatric symptoms (Beck et al., 1979). During the memory search process, individuals with mood-related symptoms are then "captured" by currently active schemas that serve to reduce the availability of cognitive resources to focus on the task at hand (Williams et al., 2007). Notably, in Study 3 of this dissertation, the observed group differences were not substantial enough to ultimately impair the overall quantity output by the dysphoric group; rather, the main difference that emerged was that the dysphoric participants were less organized in their search, and this aspect of the CaR-FA-X model offers a reasonable explanation. If a clinically diagnosed sample had been recruited, it seems likely that the group differences would have been notable on overall performance, and the disorganized strategy may have been more apparent.

The results of this dissertation can be explained through a combination of contemporary theories of OGM, notably the SMS by Conway (2005) and the CaR-FA-X by Williams et al. (2007). However, a critical aspect of this dissertation was to examine the contribution of metamemory to OGM, which will be examined next.

Metamemory. Koriat and Goldsmith (1996b) proposed a model of Strategic Regulation of Memory Accuracy and Memory Quantity in which four overarching processes exist: retrieval, monitoring, control, and performance. In this model, retrieval is synonymous with search operations, as later proposed by Koriat and colleagues (Koriat et al., 2008). In the search phase, there are both pre-retrieval and post-retrieval operations.

The pre-retrieval operations include monitoring familiarity/accessibility, deciding whether to engage or forgo a search, set search strategies, and set retrieval cues (Koriat et al., 2008). In the monitoring stage that follows, two processes are engaged including calibration, that assesses the subjective accuracy of a memory trace compared to true accuracy, and the other process is referred to as resolution, which is the ability to differentiate correct from incorrect responses at varying levels of confidence. Next, at the control stage a mechanism determines whether to volunteer the information based on the report criterion set up during the monitoring stage, which ultimately results in memory output or performance in both accuracy and quantity. The results from the series of studies in this dissertation will be examined through this model of metamemory.

The results from Study 1 of this dissertation indicate that monitoring (resolution and calibration), control, and performance remain intact in dysphoric individuals. By default, it is safe to assume that the search operation was also spared in the dysphoric group in this experiment, as performance was matched between groups. Overall, participants were able to balance the trade-off between accuracy and informativeness across all phases of the experiment. Specifically, as participants were allowed to provide wider response intervals across successive phases, their calibration scores increased such that they became better at matching their assessed accuracy with true accuracy. Resolution decreased across phases, as participants became aware that large response intervals were likely to be incorrect. Regarding control, participants strategically widened their response interval when their assessed accuracy was low, so as to maximize their chances of being correct. Also, all participants were more conservative for high penalty items.

From an autobiographical standpoint, the results from this study suggest that, at least in dysphoric individuals, OGM is not the result of impaired metamnemonic processes. Even more so, OGM may not be related to metamemory for information that is recalled immediately, as in this experiment. One study using the exact same stimuli and methodology showed that deficits in monitoring and control did emerge at immediate recall in a sample of individuals with schizophrenia, however (McAnanama, 2013). Of course, the comparison between the dysphoric undergraduate students in this dissertation and the individuals diagnosed with DSM-IV-TR schizophrenia in McAnanama's (2013) experiment is hardly justifiable from an impact of illness perspective. It may be the case that as individuals experience more severe forms of mental illness, the impact of cognitive deficits becomes increasingly prominent. Indeed, research has shown that, at least in depression, memory and executive function deficits are more pronounced in individuals with a greater burden of illness as measured by either current symptom severity or number of previous episodes (e.g., McDermott & Ebmeier, 2009). As such, it is possible that given the young sample used in the present study, the repercussions of numerous affective episodes, or severe depressive symptoms (mean scores on the DASS-21 were at the low end of the moderate range in the current experiment) has yet to impact metamemory in a meaningful way. Furthermore, given that all participants were undergraduate students, one can surmise that the present samples are high functioning, suggesting that even if they have experienced an affective episode, their cognitive decline may appear within the normal range, despite it being a decline compared to premorbid functioning. In terms of overall cognitive functioning, the groups included in this experiment were matched across estimated IQ. However, including a more comprehensive neuropsychological battery that emphasizes executive functioning and memory would have been helpful in delineating more carefully the relation between cognition and metamnemonic performance. With respect to the nature of depressive symptoms, the qualitative difference between a moderately depressed individual as measured by the DASS-21, as in this experiment, and a DSM-IV-TR or DSM-5 diagnosed individual with a major depressive episode is substantial.

Perhaps, as Study 3 found (below) search operations are the first link in the chain affected by mood symptoms, and no deficits emerged on monitoring, control, or performance processes because dysphoric participants were able to compensate and ensure adequate memory operations. As the burden of illness increases, it may become more taxing for the intact processes to adjust to an increased demand, which ultimately could result in deficits across all four metamnemonic processes.

Study 2 showed the same pattern as above for the immediate recall tasks on the AI and the EMT, a task in which participants had to read 2500 word short stories (one story was the same as used in Study 1). After a delay period, however, group performances diverged significantly on both measures of memory, in which the dysphoric group performed worse than the non-dysphoric group. Examined through the lens of the work of Goldsmith, Koriat and colleagues (Goldsmith & Koriat 2008, Koriat and Goldsmith, 1996a, 1996b, Koriat et al., 2008) several explanations are plausible. As Study 3 in this dissertation demonstrated, search operations for remote semantic autobiographical information appears to be mildly impacted in dysphoric individuals (more on that below). This may act as a starting point from which a cascade of operations stem; if the starting point is affected, anything downstream may have to compensate. The main outcome measure of Study 2 was the number of details reported on both the AI and the EMT. The results would appear to show that dysphoric participants attempted to maximize their accuracy scores at the expense of their quantity performance. Due to the experimental design of Study 2, it is impossible to say whether resolution was affected because the data preclude a resolution calculation, because it is impossible to standardize the information reported on the AI, and performance on the EMT was widely variable across participants. The AI and the EMT were unlike the QAP used in Study 1 in that the question format (free versus forced recall) differs to the point that one cannot calculate monitoring indexes without an extremely large sample size. Next, within the control process, OGM is best thought of as providing coarse-grain answers (e.g., “last week” versus “on Tuesday”). From the AI, the subjective ratings of re-experiencing address this issue, as do the objective ratings by trained scorers on measures of time integration and episodic richness. Here, the dysphoric group exhibited worse performance than the non-dysphoric group for both measures, which suggests a reporting of a more coarse-grain response. On the EMT, by contrast, these measures of subjective richness could not be obtained due to the non-autobiographical nature of the task (e.g., participants could not integrate the laboratory stimuli into the context of their “life story”). Taken together, however, the results from Study 2 are easily explained through the model proposed by Goldsmith and Koriat (2008), and serves as a solid account for OGM.

In Study 3, the dysphoric group used a less organized strategy to search and output autobiographically relevant information, as indicated by their tendency to more often switch set (e.g., report several family members, then a particular colleague, then some more family members, then other colleagues). Given that the search operation is the first stage in any memory retrieval exercise (real life or laboratory), the disorganized strategy exhibited by dysphoric individuals may be an early breakdown of metamnemonic processes. A poor search strategy is likely to have an impact on memory performance at some point; in the sample recruited for this experiment, the other metamnemonic processes may have been able to compensate due to the sample characteristics (e.g., young, little burden of illness, well-educated). Generally speaking, there are two ways to access our memory: matching a probe or by retrieving associated information (Benjamin, 2008). With respect to matching, research has shown that errors in typical memory tasks, such as list learning, are often systematic in that errors are more often due to similarity across items. For example, items that have phonological, iconic, or semantic similarity are more likely to be confused (e.g., Underwood & Zimmerman, 1973). This illustrates that in our memory system, we are somehow matching items to a large set of items; this process is thought to occur relatively quickly (Benjamin, 2008). Retrieving a memory from associated information, however, is a much slower process and akin to generative retrieval, which is more effortful. In Study 3, participants who imposed an organizational strategy on their memory search were likely engaged in generative retrieval, as associations would need to be made between the items (names) recalled by each participant. This aspect of memory search appears to be what was impaired in the dysphoric group.

Overall, it appears as though Goldsmith and Koriat's (2008) model of memory operations provide an account of OGM, although a firm conclusion cannot yet be made. The data from the series of experiments presented here offer a first step towards exploring this relation, and it is the first series of studies to apply a metamnemonic framework to AM.

Limitations and future directions. The present dissertation has some limitations that were reviewed in the discussion sections of each study. One limitation may have been the lack of a comprehensive battery of cognitive functioning to assess potential contributions of other cognitive abilities on test performance across any of the studies. Specifically, neuropsychological tests thought to tap executive function such as the Wisconsin Card Sorting Task (Berg, 1948), or memory such as the California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 1987) may have proved useful for this set of studies. Such a battery was not included due to time constraints imposed by the recruitment system.

One of the major limitations to Study 2 was that only two autobiographical events were tested: the same day, and an event from three days ago. These time periods were selected to reduce the influence of decay or interference on AM performance, while ensuring that participants did not recall a "favourite" memory that had been rehearsed numerous times that would have benefitted from re-encodings (e.g., Nadel & Moscovitch, 1997). Ideally, several AMs would have been sampled from the past year. Furthermore, although the AI is one of the most sophisticated measures of AM, it does not map directly onto the concept of OGM, but does so through a more nuanced method of scoring memories based on their constellation of episodic and semantic information. One of the reasons for using the AI rather than the AMT is that it is more amenable to investigation through the use of metamnemonic processes. Future studies would benefit from including both measures of AM. Alternatively, one potential avenue to examining the autobiographical and metamnemonic aspects of event recall might involve having participants experience highly scripted events that take place outside the laboratory (e.g., Rekkas & Constable, 2005) and testing their recollection via the AMT, AI and the QAP; the combination of these three memory measures would allow for the most robust test of OGM while allowing for the maximal amount of experimental control.

Aside from the obvious future directions of having a more acutely depressed sample and including more sample characterization measures along with several tests of AM performance, the data from the set of experiments presented here offer additional avenues to explore. First, given the dramatic effect that the delay period had on the dysphoric group in Study 2, it would be worth applying the QAP methodology to information learned after a delay period. If the results of Study 2 were any indication of the hypothesized metamemory deficits, this would be a robust test to employ. Second, and perhaps more ambitious, would be to follow the experimental design of Rekkas and Constable (2005) who took participants on an experiential tour in which scripted events took place, and then participants were tested on this information. More recent examples of this approach are currently underway at Baycrest in Toronto, Ontario (e.g., Diamond & Levine, in progress). Such experimental designs provide a high degree of control over autobiographical experiences, which has historically been one of the major critiques of AM research. Presently, some studies are using virtual reality to investigate autobiographical events, and showing that it is a valid method for creating and measuring AM (e.g., Benoit et al., 2015). Both these methods would also be amenable to using the QAP to examine search, monitoring, control, and performance processes.

Finally, regarding sample characteristics, the present sample was overwhelmingly female (close to 90%). Although depression typically affects twice as many females compared to males (Kessler, 2003), the present study is clearly over representative of females and may affect the generalizability of the data. Due to the recruitment method employed (e.g., first year psychology students), and the over representation of females enrolled in psychology courses, I did expect to recruit more females. Other studies conducted at Ryerson and our laboratory has had similar ratios of males to females, so it is unlikely that the present study per se had a gender selection bias. A future direction worth pursuing may be to examine males in greater depth, although one review has suggested that there are minimal gender differences on measures of AM (Grysman & Hudson, 2013).

Final remarks

The main motivation for the present dissertation was to challenge the conceptualization of OGM as a specific phenomenon associated with AM by examining memory more broadly, especially as it relates to the skill and strategic use of memory. Taken as a whole, the data from the present set of studies showed that the metamnemonic processes of monitoring and control remain nearly indistinguishable between dysphoric and non-dysphoric participants for events that are recalled immediately after encoding; however, pre-retrieval search processes appeared worse in dysphoric individuals for semantic autobiographical information as indicated by the tendency to search memory in a less systematic way. After a delay period, performance on measures of AM and episodic memory declines more rapidly in dysphoric than in non-dysphoric individuals. Here, the decline in performance was primarily due to a decrease in the internal (episodic) aspects of events consistent with patterns of OGM across both AM and non-autobiographical information. It seems unlikely that the aberrant search processes associated with semantic AM could account for the dramatic shift in performance between immediate and delayed recall for autobiographical and laboratory-based events, and this finding opens the door to investigate monitoring and control processes after a delay period to examine whether they may be able to account for OGM. In the context of depression, the results presented here suggest that OGM may not be a unique phenomenon associated with the disorder, but may rather be the result of having poor metamnemonic (search) processes overall.

Appendix 1: Sample Consent Form

CONSENT FORM

Study:	Strategic use of Memory
Location:	South Bond Building, Brain Imaging and Memory Lab 247
Investigators:	Matthew King, M.Sc, Psychology, Ryerson University Todd Girard, PhD, Psychology, Ryerson University

You have been asked to participate in a cognitive psychology research study. Before you give your consent to be a volunteer, it is important that you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Purpose: We are interested in how individuals strategically use their memory for every day tasks. You will be one of approximately 80 individuals participating in this study. We are recruiting from the Introduction to Psychology courses (PSY102/202).

Procedure: By participating in this study, which will take **1 hour** you will be asked to:

- Participate in a story reading task
- Answer questions about the story
- Complete a short set of cognitive tasks
- Complete a short questionnaire and interview about your mental health and behaviour (e.g., Do you find it hard to wind down? Do you tend to overreact to situations? Are you impatient?)

You will be provided short breaks should you desire between test components as needed; however, you will be encouraged to complete any given task once started.

Risks or Discomforts: You understand that the risks involved in participating in this study are small. At times during the study, you may become "mentally fatigued" or you may feel frustrated or a little disappointed with your performance. However, whenever possible, you will be provided with rest breaks, should you desire. You have the right to discontinue participation, either temporarily or permanently, at any time for any reason. If you choose to discontinue, you will still receive full credit for participation in the study. You also have the right to refuse to answer any questions.

Compensation: You understand that you will receive no direct benefit from participating in the study. You will receive 1.0% course credit towards PSY 102/202 for your time and effort participating in this study.

Benefits: The results of this study may benefit healthy and clinical populations in the future through a better understanding of the relations between strategic memory use and every day memory performance.

Confidentiality: Information learned about you in this study is confidential and will not be available to anyone except investigators. Confidentiality will be protected to the extent permitted by law. You will not be identified in any way in reports or presentations, which may arise from the study. All questionnaires will carry only an ID code with no other identifying information. Any and all paperwork (including questionnaires) will be kept in a locked cabinet in the Psychology Research and Training Centre. Only the primary investigators and students/research assistants supervised by the primary investigators will have access to the data. The master list linking names to IDs, and any other electronic files pertaining to the research, will be kept by the Principal Investigator in an encrypted, password-protected database.

Data will be stored for at least 5 years following publication of our results as common practice in our field in the rare case that researchers, including ourselves, demand re-analysis of the data for some reason. Subsequently, any personally identifying information (i.e., consent form with your name) will be confidentially shredded and destroyed. All data will also be either erased/ destroyed or stripped of any identification (i.e., we will remove reference to even your abstract Sona ID and there will be no links to your name or other identifying information maintained, even separately). Your PSY 102 or 202 instructor will only be provided with a tally of the number of credits earned during the term at the time of final grade submission. He/she will not know about the specific studies in which you participate.

Withdrawal: Participation in this study is voluntary. At any particular point in the study, you may refuse to answer any particular question. You have the right to withdraw from the study at any time without explaining your reasons to do so without penalty or loss of benefits to which you are allowed. Your choice of whether or not to participate will not influence your future relations with Ryerson University.

As a student in PSY 102 or 202, you also have the right to participate in the study but decline that we use any data collected from you for research. At any particular point in the study, you may refuse to answer any particular question. Regardless of eligibility, should you choose to opt out from data collection, a walk-through option will be offered. This option allows participants to be taken through the study protocol, without having to provide data. You would also be free to decline any further involvement. You will still receive your course credit (1%).

Questions: You are encouraged to ask any questions at any point that you have about the study and all your questions will be answered. If you have any questions about the research now, please ask. If you have questions later about the research, you may contact the investigator and if you have questions regarding your rights as a human subject and participant in this study, you may contact the Ryerson University Research Ethics Board for information (contact information on next page).

Study Agreement

By signing this form you indicate that you have discussed the study with Matthew King or any of his research associates, who have explained the purpose, procedures, and risks of the study, and have answered your questions about it.

If you have any further questions about the study or about your rights as a participant, you may telephone Dr. Todd Girard (416-979-5000 x2646 office; tgirard@psych.ryerson.ca) or Matthew King (416 979-5000 x2192; matthew1.king@psych.ryerson.ca). If you still have any questions about your rights as a participant, you may contact the Research Ethics Board:

Lynn Lavallée, Ph.D., Associate Professor, Chair, Research Ethics Board
c/o Office of the Vice President, Research and Innovation
Ryerson University, 350 Victoria Street
Toronto, ON M5B 2K3
Telephone: 416-979-5000 x 4791
Email: lavallee (at) ryerson.ca

You understand that you have the right to withdraw from the study at any time (you would still receive course credit). You understand that the information obtained about you is confidential. In any scientific report on the study the data will be presented without revealing participant identity. You have been told that by signing this consent agreement you are not giving up any of your legal rights. As a student in PSY 102 or 202, you also have the right to participate in the study but decline use of any data collected from you for research. You would still receive your credit (1% per session) for this 'walk through' option.

You acknowledge that you have been given a copy of this consent form. You agree to participate in this study.

________________________________ ________________________

Participant's signature Date

____

Participant's name (please print)

You agree to the audio recording of the memory interview and story reading task that will be used strictly for data scoring reasons, and will be tied only to your abstract participant number.

____

Participant's signature

________________________________ ____________________________

Witness Investigator Signature (required only if witness is not a primary investigator)

Appendix 2: Transcript of Fictitious Police Interview

Carefully read the two transcripts. Afterwards, your memory for events and their details, like precise times, exact distances etc will be tested.

Phil Brown is a 21-year-old university student. He was out with friends on Friday, February 15th, the day after Valentine's Day. It was also the beginning of Spring Break. He was later found in his apartment lobby unconscious. Phil has been unable to recall what happened. Below are the transcripts of the police questioning of the 2 people who were involved in the event that preceded Phil's injuries.

Transcipt A: Interrogation of *Matt Campbell*, Phil's friend.
Constable Johnson: What happened on the evening of Friday, February fifteenth?
Matt Campbell: Okay, we went to the club "Offside" at Bathurst and Adelaide.
Constable: What is the address of the club?
Matt Campbell: 109 Bathurst Street, at Adelaide.
Constable: "Offside" is at one – O – nine Bathurst. What time did you arrive at Offside?
Matt: My ticket was stamped 22:44, that's about quarter to eleven. If you get there before eleven you get a half-price drink. When you enter, you get a time stamped ticket to claim your drink. My ticket was stamped 22:44.
Constable: You arrived at "Offside" about quarter to eleven. Did you go alone to the club?
Matt: No. A buddy, Mike Jones and his girlfriend Sara Roy shared the cab from the frat house.
Constable: What is the address of the frat house?
Matt: It's near U of T, 16 Sussex Avenue
Constable: 16 Sussex Avenue, near U of T. Who did you meet at the club? Please give their first and last names.
Matt: Tony Chan, Bob Wilson, Chris Anderson and his sister Jessica. The place was packed. Not only was it the beginning of Spring Break but also the day after Valentine's Day. "Offside" used to be a hockey arena. It has 4 different levels and altogether it covers forty-four thousand square feet (44,000 ft2).
We found Phil and his girlfriend Stacey. They seemed to be quarrelling. Phil seemed a little drunk. It was really crowded and we decided to go to the upper deck where the pool tables are. Phil was getting obnoxious. He was yelling, not watching where he was going and bumping into people. Phil challenged Tony to a game of pool. Tony refused saying Phil was too drunk. But Phil taunted him and then kept bidding higher to play for money. At $225.00 dollars, Tony could not refuse.
The rest of us watched Tony and Phil play.
Mike started talking to this guy that he introduced as Pat, a buddy from high school. He was an engineering student, like us, but at Ryerson. He and his friend, Brian, were waiting for a pool table. The table next to ours became free and Pat and Brian started playing.
Constable: Can you describe Pat's friend, Brian?

Matt: He was wearing a grey Ryerson muscle shirt. He was very tall – a giant and very muscular – lean athletic build, one hundred and ninety-eight centimetres (198cm), that's almost 2 meters!
Constable: How do you know his height?
Matt: Tony asked Brian directly, I remembered he answered in metric, and that it was almost 2 metres. And he weighs 98 kilograms – almost a hundred kilos – But that is still lean and athletic for Brian's height –he has a very muscular build.
Constable: Almost two metres and almost a hundred kilos, a very tall, lean, muscular man could be threatening. I understand there was an argument, how did it start?
Matt: Brian and Pat were very good pool players and some people started to watch. Phil bumped into Brian and caused him to miss a crucial shot. Brian looked mad, but Phil didn't notice. Phil acts like he's in charge and starts ordering spectators to move back. Brian and Pat started playing again. Phil staggered into Brian. Phil apologized but Brian ignored him. Phil saw Brian's Ryerson t-shirt and said something like they need to get along because Brian was going to be working for Phil. It's a rivalry thing between Ryerson and U of T engineering. Brian walked right up to Phil and told him that he was making trouble for himself.
Tony finally beat Phil, who tried to play for double-or-nothing, but Tony wanted him to pay the $225. Instead, Phil said he would buy Tony's round of drinks, which was probably not a good idea as he had enough to drink.
Stacey and I went with him. The waitresses were going around with trays of shooters He bought four from the waitresses and at the bar he had another two. Six– that's a half dozen shooters in total.
Constable: Phil had 6 shooters?
Matt: Yes, a half-dozen shooters.
Constable: What happened after this?
Matt: We went back to the pool tables. I only had a couple of drinks that night because I still hadn't packed for our trip and we had a flight to catch to Thunder Bay this morning.
Constable: Why were you going to Thunder Bay?
Matt: Snowboarding. Phil's dad owns a resort there, everything paid for – me, Stacey, Tony, Mike and Sara were going with Phil. The flight is expensive. Even with the student airfare it costs $490, about the same as going to Europe. It is only an 82-minute flight, about an hour and a half!
Constable: Were you all going to Thunder Bay?
Matt: Yes. Because of what happened to Phil, I'm not going. I am going to lose the $490 airfare, because there are no refunds on the student ticket, too bad because I could have used the money for a trip to Europe this summer. Eighty-two (82) minutes, less than an hour and a half (1½) to fly in Ontario is as expensive as flying to Europe!
Constable: What happened when you got back to the pool tables?
Matt: Almost everyone was watching Brian and Pat shoot pool. Phil gave slurred play-by-plays to the pool game. Pat and Brian ignored him until he referred to Brian as "my future employee", just as Brian was taking another crucial shot. Brian missed and went over to Phil and stood right in front of him. Brian looked like a giant beside Phil. Phil is only 5 foot 7 inches and weighs only 130 pounds. Phil is short and skinny. And Phil said something like "that's no way to treat the boss". Brian told him to stop making trouble" That's when the eleven (11) bouncers arrived, they recognized Phil because his dad owns

the place, but none of them were as big as Brian, and you could tell they were afraid of him. Imagine almost a dozen bouncers were afraid of him! Brian and Pat left.
Phil was staggering and shouting, "*you're fired!*" at Brian and then "*you're fired!*" at the eleven (11) bouncers.
I suggested to Phil that it was time to go, but he kept drinking. He kept asking for Stacey and said he wouldn't leave without her. Eventually, Bob helped me bring him home. It was frigid outside. We heard on the radio that the wind-chill was at –37o Celsius.
Constable: Almost forty below, that is frigid. Do you know what time it was?
Matt: It was 1:25 a.m.; I remember the radio station gave the time with the temperature. So it was around half past one in the morning.
Constable: You're sure it was 1:25 am?
Matt: Yes. It's only five (5) kilometres from the club to Phil's condo, but the taxi driver was driving at 10 kilometres an hour, so it took 35 minutes.
Constable: 10 km/hour an hour is very slow driving. Did anything else delay you?
Matt: We gave the driver Phil's address, 579 Lewis Street; it's in the East End at Queen and Broadview. The driver had trouble with the one-way streets. Even though we repeated Five-Seven-Nine Lewis Street, the driver still almost drove past.
Constable: The one-way streets in that part of the East End, around Queen and Broadview are complicated.
Matt: Phil's condo building is an old factory being converted into lofts. I was surprised that the front door of the building wasn't locked.
Phil has a penthouse, on the fourteenth (14th) floor, but the elevator wasn't working. Phil had passed out and we carried him right to the penthouse.
Constable: You and Bob carried Phil 14 floors, to the top floor!
Matt: Yes, to the top of the building, to the penthouse floor. Lucky that Phil is short and skinny. I've been to his place before, it is 1750 square feet. It's huge, a 2 level loft with 2 bedrooms and 2 bathrooms. It's worth $475,000, almost half-a- million!
Constable: Are you sure that the front door of a building with condos worth a half-million-dollars does not lock?
Matt: It's still under construction. We put him on his bed.
Bob set the alarm clock for 7:16 am, which is exactly sunrise. We figured the sunrise would also help wake him up.
We had not closed the door when we came in. We checked that no one had snuck in. There are many hiding places in a 1750 square foot, two bedroom and two bathroom, two level loft. We made sure the door to his condo was locked. We tried again to lock the building door but with no luck. We caught cabs home. Bob said that Stacey had ended it with Phil and that she wasn't going to Thunder Bay. I guess that's why Phil was so obnoxious. She broke-up with him the day after Valentine's.
Constable: What time did you leave Phil's condo?
Matt: I can't be sure. I didn't get to bed until after 3. I set my clock for 7:16, sunrise, the same as Phil's so I could call Phil. When I phoned that is when you answered and asked me to come down.

Transcript B: Interrogation of *Brian Taylor* who argued with Phil.

Constable Johnson: Your date of birth?

Brian Taylor: April 19, 1987, on Easter Sunday that year.

Constable: Easter Sunday, April 19, 1987. What happened the evening of Friday, February 15th, 2008?

Brian: I talked my good friend Pat Tremblay to come with me. We've been friends since elementary school about 15 years. We were meeting my girlfriend Stacey at "Offside", at Bathurst and Adelaide. It's a converted hockey arena. There's no cover before midnight. After midnight, it is thirty dollars ($30), that's very expensive, twice what I make in an hour. I needed Pat as moral support. We have been good friends since elementary school, for 15 years.

Constable: How long have you been seeing Stacey?

Brian: Since Thanksgiving – eighteen (18) weeks.

Constable: Have you only known her for 18 weeks, since Thanksgiving?

Brian: I used to see her on campus. She and Phil were starting to break-up last September, but Stacey and Phil's families have been friends since their grandfathers served together in World War II, 64 years ago.

Constable: Sixty-four years, since the Second World War is a long time for families to know each other.

Brian: Stacey and Phil started dating as teenagers, since she was a teenager, sixteen (16) years old. I understand the break-up is hard, dating since she was 16. Constable, Stacey and I have a trip booked for Florida leaving tomorrow. Is it okay that we go?

Constable: When do you return?

Brian: We're back this weekend on Sunday, February 24, the end of Spring Break.

Constable: February 24, the end of Spring Break, this weekend – I will let you know. When did you get to "Offside"?

Brian: Just before ten, 9:50 pm. Pat and I wanted to beat the rush and after midnight, it's a thirty dollar ($30) cover. That's twice my hourly pay. My part-time job pays fifteen dollars-an- hour; it would be like giving up couple of hours work!

Constable: You state that you arrived just before ten, at 9:50 pm?

Brian: I was meeting Stacey. She was late. She had a long talk to Phil, who begged her to stick around with their friends. They were going to Thunder Bay the next day. He wanted to pretend everything was fine. She said she couldn't reason with him.
Phil had bought them executive class tickets to Thunder Bay as a Valentine's gift. They cost him eighteen hundred and thirty dollars ($1830), - eighteen – thirty each. That's almost two thousand dollars! A couple of grand for one ticket alone!

Constable: Impressive to spend $1830 on one executive class ticket.

Brian: I went to Thunder Bay by coach with Ryerson's basketball team. It's eight hundred and forty two (842) miles – a couple of days travelling with an overnight.

Constable: 842 miles in a bus and a couple of days travelling is a long time.

Brian: Stacey agreed to meet at the pool tables when she could get rid of Phil. When we got to the pool tables, Stacey was there with Phil and their friends. Phil was playing pool but you could tell he had been drinking. Pat and I decided to pretend to wait for a pool table until Stacey could get away. Then Mike, a friend of Pat's from high school, who was with Phil's friends noticed Pat. They started talking and then when a table became free beside Phil's, Mike got us to take it.

Constable: How did the fight start?
Brian: Not a fistfight. Phil started acting like a sports commentator. I ignored him because I didn't want trouble. But he got in the way of the game. Then he starts with the engineering school rivalry. It really got to me when he said he would be my boss one day. I walked up close, to intimidate him, and told him to stop making trouble. This is when the bouncers arrived and asked me to leave. Pat and I left, Stacey caught up with us at the coat check. I parked my car at Pat's place, which is only 800 metres from Offside, just a couple of blocks away. It was frigid, -37^{o} Celsius, and even a couple of blocks, 800 metres, seemed far.
Constable: Where did you go?
Brian: Stacey's apartment. She lives near Allan Gardens - 468 George Street.
Constable: Four-Six - Eight George Street.
Brian: Yes. A small bachelor apartment. Thirty-nine square metres ($39m^2$), with good windows that make the $39m^2$ seem bigger.
Constable: What time did you get to Stacey's bachelor near Allan Gardens?
Brian: Can't remember. My car took a long time to warm up. I drove fast to keep the engine warm. Stacey didn't like how fast I was driving and she timed the trip as 4 minutes 50 seconds, less than five minutes.
Constable: Four minutes and fifty seconds. About 5-minute drive to Allan Gardens. Did you leave Stacey's apartment that night.
Brian: No, we talked for a while then I slept like a log until Matt called Stacey to tell her that Phil was hurt.
Constable: I forgot to ask you: what time did you leave Offside?
Brian: Around midnight. When we got to my car, I noticed that it was 1220.
Constable: You got to your car around midnight, at 1220.

Appendix 3: Acceptable Interval Response Guide

Question	Precise	40 cents	30 cents	20 cents	10 cents	*Acceptable Descriptors*
		Acceptable ranges for Phase II & *must include precise answer*				
1. Time Matt arrived at Offside	22:44 *Note 10:44 not acceptable*	≤ 15 mins range	≤ 30 mins	≤ 45 mins	≤ 1 hour	*Quarter to eleven* *Before eleven*
2. Frat house address	16	A range of 3 that include 16 (e.g. 15-17)	Range of 6 that include 16 (11-16, or 12 – 17)	Range of 10 including #16 (e.g. 9-18)	Range of 20 including 16 (e.g. 14-33)	*Near U of T, Near Robarts Library, Near Spadina subway station* *On Sussex*
3. Offside's size	44,000 ft^2	Range of 5,000	Range of 10,000	Range of 15,000	Range of 20,000	*Size of a hockey arena/ stadium/rink* *Four levels/decks/floors*
4. Pool wager	$225	≤ $10	≤ $25	≤ $50	≤ $100	*About/around/over $200, a lot*
5. Brian's height	198 cm	≤ 5 cm	≤ 10 cm	≤ 20 cm	≤ 30 cm	*Tall, Gigantic, Athletic, Almost/around/about a couple of metres*

6. Brian's weight/build	98 kilograms	≤ 5 kilos	≤ 10 kilos	≤ 40 kilos	≤ 30 cm	*Almost/around/about 100 kilos, Muscular, Athletic, Lean*
7. Shooters	6	≤ 2 range (4-6, 5-7, 6-8)	≤ 3	≤ 4	≤ 5	*Half dozen, Around/about 6, a few*
8. Student airfare to Thunder Bay	$490	≤ $25	≤ $50	≤ $75	≤ $100	*Same as fare to Europe* *Around $500*
9. Length of flight to TB	82 minutes	≤ 10 mins range	≤ 20 mins	≤ 30 mins	≤ 40 minutes	*Around/about an hour and a half (90 min). Over an hour*
10. Phil's height	5 ft 7 in	≤ 2 inches	≤ 4 inches	≤ 6 inches	≤ 8 inches	*Short, small, "Under 6 feet", "about 5 ½ feet" below average*
11. Phil's weight	130 lbs	≤ 5	≤ 10	≤ 20	≤ 25	*Light, skinny, thin, slim*
12. Bouncers	11	≤ 2 range	≤ 3	≤ 4	≤ 5	*A dozen, around/about 10*
13. Wind chill	-37 C	≤ 2 range	≤ 5	≤ 8	≤ 10	*Frigid, very cold, "in the minus thirties" ,almost/around 40 below*
14. Time Matt & Bob left to bring Phil home.	1:25 am	≤ 5 min range	≤ 10 range	≤ 15 range	≤ 30 range	*After One, Around half-past One in the morning, Between one and two*
15. Velocity of cab	10km/hour	≤ 2 range	≤ 3	≤ 4	≤ 5	*Very slowly, half an hour ride*
16. Phil's address	579 Lewis	≤ 10	≤ 20	≤ 50	≤ 100	*Queen and Broadview, East end, on Lewis Street. Around 600 Lewis St.*

	St	range				*"in the five hundreds"*
17. Floor/level of Phil's condo	14th	≤ 2 range	≤ 3	≤ 4	≤ 5	*Penthouse, top floor/ of building*
18. Size of Phil's condo	1750 sq ft	≤ 50 range	≤ 100	≤ 500	≤ 750	*2 level, 2-bedroom, 2 bedroom & 2 bathroom, large loft*
19. How much condo is worth	$475,000	≤ 10,000 range	≤ 25,000	≤ 50,000	≤ 100,000	*About/Around/Almost Half million*
20. Alarm clock set for	7:16	≤ 5 range	≤ 15	≤ 20	≤ 30	*Sunrise, dawn, Between 7 and 8*
21. Brian's d.o.b.	April 19, 1987	≤ 2	≤ 3 days	≤ 4 days	≤ one week	*Easter, Easter Sunday, mid-April, April, late eighties, Spring*
22. Brian & Pat have been friends	15 years	≤ 2 range	≤ 5	≤ 8	≤ 10	*Since elementary/grade school. More than/at least a decade*
23. Stacey & Brian dating	18 weeks	≤ 2 range	≤ 4	≤ 8	≤ 10	*Since Thanksgiving, Since October, Since the Fall/Autumn, A few months, Most of the school year*
24. Stacey & Phil's families have been friends	64 years	≤ 5 range	≤ 10	≤ 30	≤ 75	*Since the second World War, Since WW II, Their grandfathers were friends*
25. Stacey's age when started dating Phil	16	≤ 2 range	≤ 3	≤ 4	≤ 5	*Teenager, mid teens, since high school*
26. Returning from Florida	February 24	≤ 2	≤ 3 days	≤ 4 days	≤ one week	*End of Spring break, late February*

27. Offside cover charge after midnight	$30	≤ 2 range	≤ 5	≤ 10	≤ 15	*Couple of hours wages, double hourly wage, steep, expensive, rip-off*
28. Brian arrive at Offside	9:50	≤ 5 range	≤ 15	≤ 20	≤ 30	*Just before ten, Around/About ten*
29. Executive class tickets to TB	$1830	≤ 50 range	≤ 100	≤ 250	≤ 500	*Almost two thousand dollars, A couple of grand, (around 4 thousands or a few grand* if interpreted as total for 2 tickets*) as much as a flight to Asia/ Australia/ Africa/South America…*
30. Distance to Thunder Bay	842	≤ 50 range	≤ 100	≤ 150	≤ 200	*A couple (2) days travelling, An overnight, Near Manitoba, Western Lake Superior*
31. Walking distance to Pat's place from Offside	800 metres	≤ 25 range	≤ 50	≤ 100	≤ 200	*A couple of blocks, Less than a kilometre, about/around half mile*
32. Stacey's address	468	≤ 10 range	≤ 20	≤ 50	≤ 100	*Near Allen Gardens, Near Ryerson, On George Street*

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Glossary

AI	Autobiographical Interview
AM	Autobiographical Memory
ANDI	Adjusted Normalized Discrimination Index
ANOVA	Analysis of Variance
CaR-FA-X	Capture and Rumination, Functional Avoidance, Executive Dysfunction
COWAT	Controlled Oral Word Association Test
DASS-21	Depression, Anxiety, and Stress Scale – 21 item version
DV	Dependent Variable
EMT	Episodic Memory Task
MDD	Major Depressive Disorder
MTL	Medial Temporal Lobe
MTT	Multiple Trace Theory
NIM	Negative Impression Management
OGM	Overgeneral Memory/ Overgeneral Autobiographical Memory
PAI	Personality Assessment Inventory
PAS	Personality Assessment Screener
PIM	Positive Impression Management
P_{RC}	Report Criterion
QAP	Quantity-Accuracy Profile
SMS	Self-Memory System
SPSS	Statistical Package for the Social Sciences
WAIS-III	Wechsler Adult Intelligence Scale 3rd Edition
WMC	Working Memory Capacity