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Does overgeneral autobiographical memory result from poor memory for task instructions?

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Considerable previous research has shown that retrieval of overgeneral autobiographical memories (OGM) is elevated among individuals suffering from various emotional disorders and those with a history of trauma. Although previous theories suggest that OGM serves the function of regulating acute negative affect, it is also possible that OGM results from difficulties in keeping the instruction set for the Autobiographical Memory Test (AMT) in working memory, or what has been coined ''secondary goal neglect'' (Dalgleish, 2004). The present study tested whether OGM is associated with poor memory for the task's instruction set, and whether an instruction set reminder would improve memory specificity over repeated trials. Multilevel modelling data-analytic techniques demonstrated a significant relationship between poor recall of instruction set and probability of retrieving OGMs. Providing an instruction set reminder for the AMT relative to a control task's instruction set improved memory specificity immediately afterward.

Overgeneral autobiographical memory (OGM) refers to the tendency to retrieve categoric memories (memories for a category of an event; e.g., ''Going to the library to study'') or extended memories (memories that last longer than a day; e.g., ''My summer vacation'') when asked to provide specific memories (memories lasting less than a day and of a particular event; e.g., ''When I graduated from high school''). Over the past 20 years a considerable amount of research has demonstrated OGM across different clinical populations, including individuals with depressive symptomatology (e.g., Brittlebank, Scott, Williams, & Ferrier, 1993; Peeters, Wessel, Merckelbach, & Boon-Vermeeren, 2002; Williams & Scott, 1988; Williams et al., 2007), parasuicidal behaviour (Williams & Broadbent, 1986), acute stress disorder (Harvey, Bryant, & Dang, 1998), post-traumatic stress disorder (Kuyken & Brewin, 1995; McNally, Lasko, Macklin, & Pitman, 1995; Williams et al., 2007), and schizophrenia (Neumann, Blairy, Lecompte, Philippot, 2007; Wood, Brewin, & McLeod, 2006). The occurrence of OGM has also predicted more prolonged depressive episodes (Brittlebank et al., 1993; Peeters et al., 2002) and prospectively predicted the development of depressive symptomatology (Gibbs & Rude, 2004; Mackinger, Loschin, & Leibetseder, 2000; Raes, Hermans, Williams, Beyers, Brunfaut, & Eelen, 2006b; van Minnen, Wessel, Verhaak, & Smeenk, 2005), suggesting that it may be an important factor in the development and course of emotional disorders.

Williams (1996) suggested that a descriptions theory of memory (Conway & Pleydell-Pearce, 2000; Norman & Bobrow, 1979) may provide a useful framework in which to understand OGM. According to a descriptions theory of memory, certain details of a memory are automatically constructed into a partial description of the memory (e.g., my most recent supermarket trip). This partial description acts as an index of the

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memory and is placed among other partial descriptions of similar memories (if there are others), which form a category of memory descriptions (e.g., when I go to the supermarket). Memories, therefore, are coded in a hierarchical order of a general category of memories, partial descriptions or intermediate memories within that category, and finally, the specific memory. Williams (1996) suggested that when individuals with OGM conduct a memory search, they stop the memory search at a general level; they arrive at the partial description, or intermediate memory, within a category, but stop short of retrieving the specific memory. However, because the memory search is attempting to achieve a specific memory, it continues searching and accessing other intermediate memories. This creates an elaborate network of categoric intermediate memories, which are more easily accessed in the future. Therefore, a mnemonic cue will activate a memory search that becomes stuck in a ''mnemonic interlock'' of intermediate self-descriptions, or OGM.

Williams (1996) hypothesised that efforts to regulate negative affect can contribute to an overgeneral retrieval style. This affect regulation hypothesis suggests that an overgeneral retrieval style helps to prevent painful memories, and their associated affect, from being retrieved. According to this model, young children tend to recall memories in an overgeneral manner because they do not yet have the cognitive abilities necessary to retrieve *specific* autobiographical memories. However, traumatised children continue to use an overgeneral retrieval style even as their cognitive abilities develop in order to avoid negative affect associated with specific memories. That is, they learn to abort a memory search at an overgeneral intermediate description in order to avoid the negativity associated with specific memories. We should also note that although affect regulation and functional avoidance remains at the heart of this model, its most recent articulation recognises a number of other processes, such as rumination and ''capture'' by material generated in memory search involving self-relevant concerns, that may contribute to OGM (Williams et al., 2007).

Studies demonstrating an association between trauma and OGM offer support for this model. For example, Kuyken and Brewin (1995) found that depressed individuals with childhood physical and sexual abuse had greater OGM than depressed individuals without abuse (see also Hermans et al., 2004; Raes, Hermans, de Decker, Eelen, & Williams, 2003; Raes, Hermans, William, & Eelen, 2005). These results are consistent with the possibility that an overgeneral retrieval style was adopted by those who had experienced childhood abuse as a way to cope with the negative experiences. Other studies conducted by Raes and colleagues have offered more direct support for the affect regulation hypothesis. Raes et al. (2003) measured the amount of subjective stress in individuals who had just completed a frustrating task, and found that those individuals who showed lower levels of specificity in their memories experienced less distress than those individuals with higher specificity. In a later study, Raes and colleagues replicated these findings, and also found that OGM is associated with a repressive coping style (Raes, Hermans, Williams, & Eelen, 2006a). More recently, Hermans and colleagues (2007) found that students who demonstrated greater OGM experienced less emotional distress 9 weeks after having failed an exam. Overall, these studies suggest that OGM appears to buffer against the negative effects of stressful events, and possibly acts as an avoidant coping style.

While there appears to be strong evidence in support of the affect regulation hypothesis, there are several findings that this model fails to explain. For example, the affect regulation hypothesis fails to explain why OGM has been demonstrated among *recently* traumatised adults or why it is impacted by fluctuations in current mood state. For example, Harvey et al. (1998) found elevated OGM in individuals with acute stress disorder following a motor vehicle accident. Likewise, a recent study demonstrated that negative mood inductions lead to OGM among healthy individuals with no prior history of depression (Au-Yeung, Dalgleish, Golden, & Schartau, 2005).

In response to such issues Dalgleish and colleagues (2007) proposed an alternative to the affect regulation hypothesis, positing that OGM results from reduced executive control in working memory. Executive control involves cognitive operations necessary for goal-oriented behaviour, which may include monitoring and changing behaviour, the initiation and prevention of actions, and the planning of new behaviour. An accumulation of research has demonstrated that these operations are impaired in depressed individuals (for meta-analytic reviews, see Henry & Crawford, 2005; Veiel, 1997; Zakzanis, Leach, &

Kaplan, 1998), possibly as the result of reduced cognitive initiative (Hertel, 2000). According to this account, any task that requires executive control will likely result in poor performance from depressed individuals due to their inability to initiate appropriate strategies or hypotheses when performing the task. Therefore, OGM may result from an inability to effectively apply executive control. In order to test this hypothesis, Dalgleish and colleagues (2007) conducted a series of studies that manipulated the load on executive functioning during the Autobiographical Memory Test (AMT; which is the test most commonly used to measure OGM), and found that the relationship between depressive symptomatology and OGM is largely accounted for by reduced executive control. Across a number of studies, these investigators found that: (1) OGM on the AMT shared variance with measures of executive control; (2) this relationship was due to the generation of errors on tasks that required the use of executive control; (3) the relationship between depressive symptomatology and OGM was largely accounted for by reduced executive control; and (4) there was a stronger correlation between depressive symptomatology and OGM when there was a load on executive control.

While the studies by Dalgleish et al. (2007) provide preliminary evidence implicating impaired executive control in the occurrence of OGM, it is unclear which aspects of executive control specifically account for the relationship between depressive symptomatology and OGM. One possibility posited by these investigators is that OGM occurs due to difficulty maintaining each of the AMT's task parameters in working memory, or what has been coined "secondary goal neglect" (Dalgleish, 2004). That is, individuals become more overgeneral in their recall of memories during the AMT because they are focusing on the primary goal of recalling memories, but are neglecting the secondary goal to recall specific memories as stated in the task's instruction set. While this explanation appears plausible, it has not been directly tested. Therefore, the present study was designed to examine whether secondary goal neglect is responsible for OGM.

Although OGM traditionally has been measured using a summed total score of memory generality or specificity, several recent studies have used multilevel modelling data-analytic techniques to examine the trajectory of the probability of retrieving OGMs over the series of cue word presentations in the AMT within each participant (see Roberts, Carlos, & Kashdan, 2006; Roberts & Raes, 2007). In other words, the analysis would focus on memories retrieved on individual trials rather than on aggregated performance on the task as a whole. This way, each participant has an initial predicted probability of OGM (an intercept), and an estimated linear trajectory of probability of OGM over time (slope). These studies have found that the probability of retrieving OGMs tends to increase over the initial series of cue words. Because the secondary goal neglect hypothesis suggests that a failure in the *maintenance* of instruction set leads to OGM, we applied these multilevel modelling techniques in the current study in order to examine the trajectories of the probability of retrieving OGMs as the task progresses.

In order to examine whether OGM results from the inability to maintain the AMT's instruction set in working memory we tested two hypotheses. Our first hypothesis was that poor recall of the instruction set would be associated with greater retrieval of OGMs. Specifically, we hypothesised that poor recall of instruction set would be associated with a greater probability of retrieving OGMs at the beginning of the task and a greater increase in the probability of retrieving OGMs over repeated trials of the AMT due to failure to maintain the task's instruction set in memory. Therefore, we would expect that those individuals with poor instruction set recall would begin with a higher intercept of OGM probability and progress with a sharper increasing upward slope of OGM probability trial by trial.

The secondary goal neglect hypothesis suggests that a failure in *maintenance* of instruction set leads to OGM. In other words, over time the secondary goal to be specific is no longer maintained, resulting in increased probability of retrieving OGMs over repeated trials. Therefore, providing a reminder of the AMT instruction set should reawaken this secondary goal. Our second hypothesis was that providing a reminder of the AMT's instruction set relative to a control task's instruction set would reset the memory trajectory. To provide this control condition, we created a Free Association Task (FAT) that was administered before the AMT. The FAT's instruction set was similar to the AMT's, but without any mention of memory or specificity.

METHOD

Participants

A total of 134 undergraduate students (42 male), enrolled in either an upper-level or introductory psychology course at the University at Buffalo, participated. Participants had an average age of 20 years ($SD = 4.6$). Ethnicity was divided as follows: 62.5% Caucasian, 19.2% Asian/Pacific Islander, 8.7% African American, 5.8% Hispanic, and 3.8% Other.

Measures

Depressive symptoms. The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) was used to measure depressive severity. The BDI-II is a 21-item self-report questionnaire that rates each question on a scale of 0 to 3 with total scores ranging from 0 to 63. It has shown high internal consistency ($\alpha = .92$; Beck et al., 1996; $\alpha = .91$; Dozois, Dobson, & Ahnberg, 1998) and good convergent and discriminant validity (Beck et al., 1996). Coefficient alpha for the present sample was .88.

Autobiographical memory. The Autobiographical Memory Test (AMT; Williams & Broadbent, 1986) was administered to measure specificity of autobiographical memory. Cue words, ordered sequentially by neutral (e.g., onion, pianist), negative (e.g., fault, hurt), and positive (e.g., pleasant, carefree) valence, were presented in a single fixed sequence to all participants. Three practice cue words were given prior to this word list. If participants did not provide a memory within 30 seconds, it was considered an omission. Although responses were audio-taped, they were coded as either ''specific'' (memories lasting less than 24 hours with a distinct time and place), or ''general'' (memories that lasted over a day, were not a distinct time or place, or were a summary of many similar events) in real time during the administration of the task. Omissions were excluded from data analyses. Inter-rater reliability was high (kappa = .89).

Free association. The Free Association Test (FAT) was created to act as a control condition. Specifically, when testing the impact of an instruction set reminder on OGM we wanted to compare the impact of a reminder of the AMT's instructions to a reminder of the instructions to a similar but unrelated task. In the FAT participants were asked to recall a semantic association to 18 neutral cue words (e.g., bubble). Three practice cues were given prior to beginning testing. If participants did not respond with an association within 30 seconds the administrator moved on to the next word. Responses were not coded, although the administrator appeared to be doing so in order to appear consistent with the AMT.

Instruction set recall. A coding scheme was created to measure participants' recall of instruction set. The instruction set for the AMT and FAT each contained six components that were individually assessed. For the AMT instruction set, the components were: (1) Give a memory; (2) The memory should be related to the word on the card; (3) Can be recent or long time ago; (4) Can be important or trivial; (5) Should be of a specific event; and (6) Different memory for each cue word. For the FAT instruction set, the components were: (1) Give a word or phrase; (2) The word or phrase should be related to the word on the card; (3) Can be a single word or phrase; (4) Can be logically related to the word or just comes to mind; (5) Should be related enough that you can explain if questioned; and (6) Different word or phrase for each cue word. One point was given for each component recalled with total scores ranging from 0 to 6. Inter-rater reliability for this coding scheme was high (kappa = .86).

Procedure

Participants signed up for the study in order to receive either course credit or extra credit. Following consent, participants completed self-report measures that included the BDI-II. All participants were next administered the FAT. Following the FAT, participants were administered the first nine cue words of the AMT. Once the first nine cue words were administered, participants were randomly assigned to write down from memory either the instructions for the FAT or the AMT. Participants were then reminded of the instructions for either the AMT (AMT reminder condition) or the FAT (which served as the control condition), corresponding to whichever task instruction set they were asked to recall. Participants were then administered the last nine cue words of the AMT. Interrupting the task in this manner allowed us to test the effect of providing an AMT instruction set reminder

(relative to the control condition in which participants were given a reminder about AMT irrelevant instructions) on performance in the second half of the AMT.

RESULTS

Due to difficulties with understanding the task, 8 participants were excluded from the analyses (5 male), leaving a final sample of 126. There were no significant differences of age, gender, ethnicity, BDI score, or year in school between participants assigned to the AMT instruction set reminder versus control conditions. The average BDI-II score was 9.3 ($SD = 7.1$; range = 0–40). The average number of OGMs was 4.5 ($SD = 3.3$), whereas the average number of specific memories was 13 ($SD = 3.3$), and the average number of omissions was 0.4 ($SD = 1.1$). For Instruction Set Recall, the average score was 2.6 ($SD = 1.2$).

All analyses were conducted using the R 2.4.0 statistical package (R Development Core Team, 2006). Because our dependent variable (OGM) was coded dichotomously (0 = specific; 1 = general) we used Penalised Quasi-Likelihood approximations from the MASS package (Venables & Ripley, 2002), which makes repeated calls to the multilevel modelling package NLME (Pinheiro & Bates, 2000). Analyses were conducted in a step-wise manner in which main effects were entered as a block in Step 1, and two-way interactions were entered at Step 2.

While this study did not intend to evaluate the relationship between depression and OGM, a large body of research suggests that depression is associated with elevated OGM (see van Vreeswijk & Jan de Wilde, 2004, for a review). Therefore it is possible that performance on the AMT may be a function of depressive severity as opposed to secondary goal neglect. In order to control for shared variance, we included depression as a covariate in our analyses.

Association between instruction set recall and OGM

Our first hypothesis was that poor memory for the instruction set would be associated with greater OGM. We tested this hypothesis by examining whether poor recall of instruction set, represented by the independent variable ''Instruction Set Recall'', would be associated with greater OGM probability (the dependent variable) at the beginning of the task (intercept) and a greater increase in OGM probability over repeated trials of the AMT (slope), represented by the independent variable ''Trial'' (which refers to the cue number in the series of presentations on the AMT). Therefore we expected to find a significant main effect of Instruction Set Recall (intercept) and an Instruction Set Recall × Trial interaction (Slope). Analyses were restricted to the first nine cue words, or first half, of the AMT prior to the instruction set reminder. Because there was no effect of ''Condition'' (whether participants were asked to recall either the FAT or AMT's instruction set) on Instruction Set Recall, $\beta = .05$, $t(121) = .29$, $p = .77$, we collapsed across conditions so that Instruction Set Recall acted as a measure of the degree to which participants could hold in memory the various components of an instruction set.

Results indicated a significant main effect of Trial, $\beta = .10$, $t(1006) = 3.77$, $p = < .001$, and Instruction Set Recall, $\beta = .17$, $t(123) = 2.01$, $p < .05$, on probability of OGM, whereas the BDI was not statistically significant, $\beta = .01$, $t(123) = .96$ $p = .34$. The probability of OGMs increased trial by trial and was greater in persons with relatively poorer instruction set recall. It is important to emphasise that poor instruction set recall represents a general deficiency in memory for instructions on either the AMT or the FAT (depending on which condition the participant had been assigned to). In contrast to our hypothesis, the Instruction Set Recall × Trial interaction was not statistically significant, $\beta = .03$, $t(1006) = 1.57$, $p = .12$. These results suggest that individuals with relatively poorer instruction set recall had a greater probability of retrieving OGMs, but were not prone to becoming *increasingly* overgeneral as the trial sequence progressed (although the non-significant trend was in this direction).[1]

[1] Additional analyses were conducted that included valence of cue word as a covariate. Results were similar to those reported above, with one exception. In these analyses the effect of Trial was only marginal, $\beta = .06$, $t(1004) = 1.73$, $p = .08$. To explore this difference further we examined the effect of Trial in each word type separately. There were significant main effects of Trial for positive, $\beta = .10$, $t(251) = 2.34$, $p < .05$, and negative words, $\beta = .17$, $t(251) = 3.54$, $p < .001$, but not for neutral words, $\beta = .04$, $t(251) = 1.01$, $p = .31$.

Impact of AMT instruction set reminder on memory specificity

Our second hypothesis was that an instruction set reminder for the AMT relative to a reminder for the FAT would decrease the probability of retrieving OGMs (the dependent variable). We examined this hypothesis by testing the interaction between the independent variables "Condition" (AMT reminder condition versus FAT reminder condition) and "Trial" during the second nine cue words of the AMT (i.e., the second half, immediately after participants were given an instruction set reminder for either the AMT or FAT). We predicted that the AMT reminder condition would be associated with a lower intercept (i.e., lower probability of retrieving OGMs at the beginning of this sequence). As a point of comparison, these effects were also examined during the first nine cue words (i.e., before participants were given an instruction set reminder).

For the first half of the AMT there was a significant main effect of Trial, $\beta = .09$, $t(1006) = 3.77$, $p < .001$, although the BDI was non-significant, $\beta = .01$, $t(123) = .92$, $p = .36$. As seen in Figure 1a, the probability of retrieving OGMs increased across the trial sequence. As expected, given that the instruction set reminders had not yet been given, the main effect of Condition, $\beta = .09$, $t(123) = 0.46$, $p = .65$, and the Condition × Trial interaction, $\beta = .03$, $t(1006) = 0.54$, $p = .59$, were not statistically significant.

Focusing on the second half of the AMT, there was a significant main effect of BDI, $\beta = .05$, $t(123) = 2.80$, $p < .01$, and Trial, $\beta = .05$, $t(1006) = 1.98$, $p < .05$. Higher depressive symptoms were associated with greater probability of retrieving OGMs, whereas higher trial number was associated with lower probability of retrieving OGMs. However, these results were qualified by a statistically significant Condition × Trial interaction, $\beta = .13$, $t(1006) = 2.42$, $p < .05$. As seen in Figure 1b, those participants given the AMT instruction set reminder started with a lower intercept of OGM probability that remained low and constant throughout the trial sequence, whereas those participants given the FAT instruction set reminder started with a higher intercept of OGM probability that decreased steadily throughout the trial sequence.[2]

DISCUSSION

The present study was designed to determine whether secondary goal neglect is responsible for OGM. We examined whether a focus on the primary goal to retrieve memories and neglect of the secondary goal to retrieve *specific* memories (as stated in the instruction set) was associated with OGM. Our results suggest that poor instruction set recall is associated with greater retrieval of OGMs, and that a reminder of the AMT instruction set decreases retrieval of OGMs immediately after the reminder. Therefore secondary goal neglect may act as one of the deficits in executive control that contributes to OGM. In other words, to some extent relatively poor performance on the AMT (i.e., retrieval of OGMs) is the result of participants having difficulty maintaining the instruction set in working memory.

The present study took a novel approach to examining executive control by examining performance on the AMT on a trial-by-trial basis. This approach is grounded by several recent studies that have found that the probability of retrieving OGMs systematically varies over the cue sequence in the form of an inverted U. Specifically, these studies have found that the probability of retrieving OGMs steadily increases trial-by-trial, plateaus, and then decreases towards the end of the task (Roberts et al., 2006; Roberts & Raes, 2007) and this effect is independent of the particular order of cue words presented (Roberts, Carlos, & Yanes, 2008). The present study was able to examine whether the probability of retrieving OGMs varied over time as a function of instruction set recall. Results indicated that during the first half of the trial sequence individuals with poorer memories for task instruction sets have a higher probability of retrieving OGMs (although they do not have steeper slopes, indicating that their performance does not decline more rapidly), and that an instruction-set reminder can reset these trajectories. These results are consistent with what we expected from previous research on the trajectory of OGM, and provides further support that examining performance on the AMT as the task

[2] When analyses were restricted to only the participants who received an instruction set reminder for the AMT we obtained similar results. Specifically, there was a statistically significant effect of Trial, $\beta = .11$, $t(518) = 3.02$, $p < .005$, and a marginal trend for Instruction Set Recall, $\beta = .22$, $t(62) = 1.57$, $p = .12$. Furthermore, including valence of cue word as a covariate had no effect on the results.

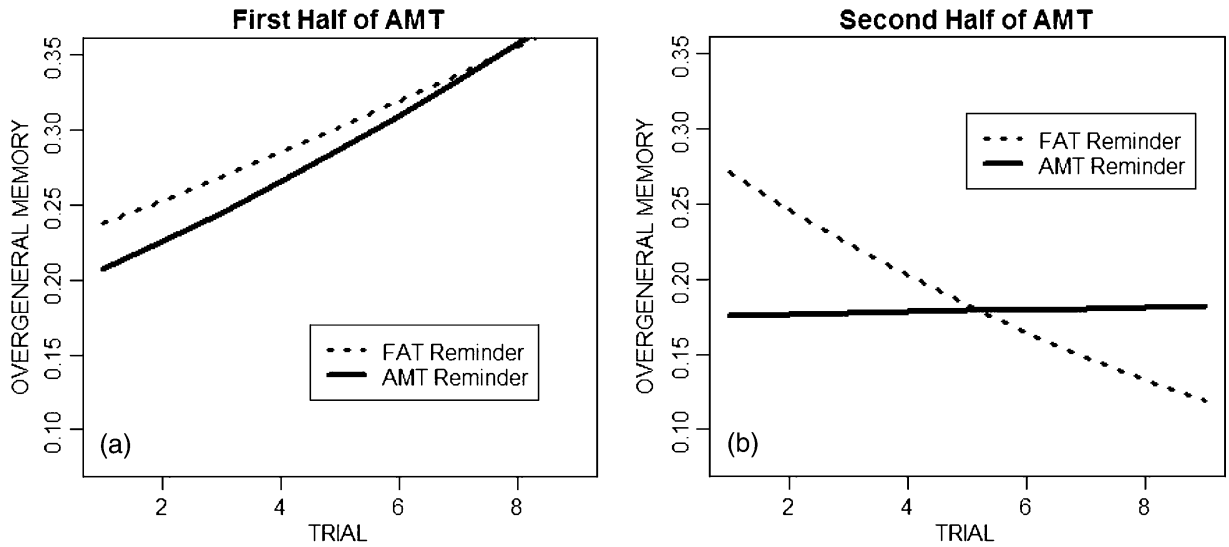

Figure 1. Trajectories of probability of overgeneral autobiographical memory (OGM) in the first and second halves of the Autobiographical Memory Test (AMT). (a) Trajectory of probability of OGM in the first half of the AMT; (b) Trajectory of probability of OGM in the second half of the AMT.

progresses offers a unique and valuable perspective of the functioning of autobiographical memory retrieval.

Although our data suggest that maintenance of the secondary task's instruction set in working memory can play a role in OGM, we do not believe that our study in any way conflicts with the possibility that one's history of regulating affect through overgenerality also plays a role. Both affect regulation/functional avoidance and reduced executive control may be operative in the generation of OGMs (see William et al., 2007). If so, it would be important for future studies designed to test the affect regulation hypothesis to minimise and/or statistically control variance in overgenerality that is related to secondary goal neglect. For example, some studies provide corrective feedback after each mistake (i.e., OGM) on the AMT in which the instructions are partially restated. This would likely minimise the impact of secondary goal neglect on OGM. Likewise, studies could include various measures of executive control that could then be used as covariates in analyses. This approach would involve removal of variance shared between OGM and executive control.

In addition to the role of memory for instruction set, the present study found that elevated depressive symptoms were associated with greater OGM in the second half of the AMT, whereas there was no association between depression and OGM during the first half of the AMT. This finding is consistent with recent research demonstrating that the impact of depressive symptoms and low self-esteem can vary across the sequence of cue presentations in the AMT (Roberts et al., 2006). The present study suggests that, at least in a non-clinical sample, depressive symptoms may have greater impact on the retrieval of autobiographical memories later in the sequence of cue words and conversely have little impact during initial cue presentations. It may be that the impact of individual difference factors such as depressive symptoms and self-esteem are only apparent later in the cue sequence after executive control resources have been somewhat depleted by the ongoing demands of the task. If replicated, this finding might suggest that depressed patients experiencing a heavy load on executive control (e.g., complicated tasks or tasks that require multi-tasking) may benefit from simplifying tasks or providing reminders of the task's instructions or goals in order to lessen the load on executive control. Future research is needed to investigate the nature of the relationship between OGM, reduced executive control, and clinical states such as depression.

Given that the study reflects preliminary research examining secondary goal neglect from a novel perspective, there are several limitations that should be addressed in future studies. First, our sample consisted of non-clinical undergraduate students who likely had less need for emotion regulation compared to the more traumatised

clinical samples used in much past OGM research. Perhaps OGM serves different functions in different samples. It would be valuable for future studies to examine the impact of both executive control and affect regulation in the same study, and to determine if their relative contributions vary as a function of past trauma. In addition, the instruction set reminder was confounded with the heightened processing that took place during the recall task. Specifically, participants given the AMT instruction set reminder had just spent the previous few minutes thinking intently about those same instructions, whereas participants in the control condition had been thinking intently about task-irrelevant (and potentially distracting) instructions. Therefore the increased specificity seen after the reminder could have been the result of the reminder itself, heightened processing of the relevant instructions during the recall tasks, distraction related to processing task irrelevant instructions in the control condition, or some combination of each of these. Future studies need to disentangle these processes. Furthermore, it is unclear whether interrupting the AMT midstream on its own had an impact on subsequent performance. Despite these limitations, our results provide additional support for Dalgleish's et al.'s (2007) executive control hypothesis, particularly for the role of secondary goal neglect in the generation of OGM.

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