Published in final edited form as:

Memory. 2014 November ; 22(8): 881–889. doi:10.1080/09658211.2013.839710.

An ‘alternating instructions’ version of the Autobiographical Memory Test for assessing autobiographical memory specificity in non-clinical populations

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Abstract

There is limited research regarding how executive processes contribute to key cognitive deficits in depression, particularly impoverished retrieval of autobiographical memory. This study tested a novel version of the Autobiographical Memory Test (AMT), the ‘Alternating Instructions’ AMT (AMT-AI), to determine how participants could flexibly retrieve specific and categoric autobiographical memories. The AMT-AI consisted of a standard AMT (AMT-S), a categoric version of the AMT (AMT-R) and a section of alternating instructions (AI) in which the rules required the participant to alternate between retrieval of categoric and specific memories. Forty-nine university students completed the AMT-AI, and self-report measures of depressive symptomatology and ruminative thinking. Results showed that the mean proportion of specific memories recalled on the AMT-AI was significantly lower than on the AMT-S. Also, reduced memory specificity on the AMT-AI, but not the AMT-S, was significantly negatively correlated with increased scores on measures of depressive symptomatology and ruminative thinking. Collectively the data suggested that the AMT-AI, relative to the traditional AMT, may be more sensitive to memory specificity in non-clinical populations. Future research is warranted to further determine the psychometric properties and utility of the AMT-AI.

Keywords

Autobiographical Memory Test; executive function; memory; neuropsychology; depression

Introduction

There is evidence that depression is associated with executive deficits (McClintock, Husain, Greer & Cullum, 2010; Synder, in press). Indeed, executive deficits are prominent in numerous theoretical frameworks for explaining the occurrence of depression (Barrett,

Tugade & Engle, 2004). However, few studies have investigated how executive processes contribute to key cognitive deficits in depression, such as impoverished retrieval of autobiographical memory. Dalgleish, Williams, Golden, Perkins, Barrett, Barnard & Watkins (2007) conducted one of the few studies that examined this question. Specifically, they assessed how autobiographical memory was associated with tasks of executive control and found that errors on the control tasks negatively correlated with ability to retrieve specific memories, or memories of contextualized events that lasted less than one day. Those investigators also constructed a task, the reverse Autobiographical Memory Test (AMT-R), which required participants to retrieve categoric memories, or memories for collections of events. Even though participants retrieved categoric memories that were easier to access than specific memories according to the generative retrieval framework, they nonetheless still made errors by reporting specific memories. The authors suggested that the cues used to elicit categoric memories would also automatically bring some specific memories to mind and that due to poor executive control participants would incorrectly report these memories. Indeed, the tendency to report specific memories on the AMT-R was associated with poorer performance on a measure of executive control, the operational span task (OSPAN). Thus Dalgleish et al., (2007) demonstrated that there was impaired ability to inhibit inappropriate responses, as specific memories were produced when the rule was to retrieve categoric memories. Subsequently, Raes, Verstraeten, Bijttebier, Vasey & Dalgleish (2010) found that a self-report measure of inhibitory control mediated the association between depressed mood and the ability to retrieve specific autobiographical memories in a sample of children. A further study by Dalgleish, Rolfe, Golden, Dunn & Barnard (2008) also employed the AMT-R in a sample with post-traumatic stress disorder. They found a negative correlation between symptoms of post-traumatic stress disorder (PTSD) and specificity scores on the AMT-R. Further, there was no correlation between the ability to retrieve specific memories and performance on a measure of executive control. Their findings were interpreted as being in line with the affect regulation hypotheses, whereby greater categoric retrieval occurs with increasing PTSD symptoms in order to minimize the negative affect associated with retrieving negative specific memories. Thus, executive control seems to play a greater role in the retrieval of specific memories in depression as opposed to PTSD where affect regulation is more important.

Executive functioning is a domain that is comprised of different cognitive processes such as initiation, planning, inhibition, and cognitive flexibility (Burgess & Shallice, 1996). Cognitive flexibility refers to the ability to conceptually shift sets (Miyake, Friedman, Emerson, Witzki, Howerter & Wager, 2000) and emerged as one of three subfactors from a confirmatory factor analysis on range of executive tasks (Miyake et al., 2000), with the remaining two factors being updating/monitoring and inhibition. Flexibility in using contextualized specific memories and more general abstract summary information is important for optimizing everyday functioning. For some common functions, access to more detailed information is clearly beneficial. In social problem solving, for example, the retrieval of specific memories is associated with producing more effective solutions to social problems (Goddard, Dritschel & Burton, 1996). Social problems can be solved in a variety of ways, and access to more detailed information contained in specific memories provides more information regarding their solution. In contrast, other everyday activities (e.g.,

planning what will be done during the week) rely in part on the efficient retrieval of summaries of information regarding activities in the past (e.g., attending music classes on Wednesdays).

Cognitive flexibility with respect to memory retrieval may potentially contribute to the regulation of emotions. Emotion dysregulation is a central feature of depression (Gotlib & Joorman, 2010). When in a negative mood, depressed individuals perseverate on negative thoughts and tend to engage in ruminative thinking styles that maintain or augment the negative mood. Retrieval of overgeneral categoric memories can arise due to functional avoidance (Williams, Barnhofer, Crane, Hermans, Raes, Watkins & Dalgleish, 2007). Functional avoidance takes place when the retrieval of overgeneral memories occurs to minimize negative affect as these memories, relative to specific negative memories, contain fewer details about the sensory and perceptual features of negative experiences (Williams et al., 2007). Indeed, Hermans, De Franc, Raes, Williams & Eelen (2005) found a positive correlation between scores on a range of avoidance questionnaires including social behavioral avoidance, experiential avoidance, and thought suppression and the retrieval of overgeneral memories. However, there is also evidence that depressed individuals retrieve overgeneral memories to positive cues (Williams et al., 2007), which could indicate an inflexibility in using this memory retrieval style. This more abstract retrieval of positive memories would be less effective in encouraging concrete processing of positive memories and has been shown to be an important factor in the ability to regulate affect (Wermer-Seidler & Moulds, 2012).

As cognitive flexibility is conceived as involving conceptual set shifting (Miyake et al., 2000) it has traditionally been assessed by card sorting tasks or alternating trail-making tests that require participants to shift between categories. Inhibition is a component process of cognitive flexibility as participants must inhibit previous responses in order to shift categories. However, in addition to inhibition, individuals must also initiate a new action. Perseveration on a particular rule is deemed a sign of inflexibility. Perseverative negative thinking characterizes rumination (Whitmer & Banich, 2006), the tendency to think about the causes and consequences of negative events (Nolen-Hoeksema, 1991). Therefore, individuals who ruminate should have more difficulties in being flexible in how they retrieve their autobiographical memories according to cueing task demands. Depression is also associated with cognitive inflexibility (Gotlib & Joorman, 2010). Indeed, Grant, Thase, & Sweeney (2001) found that outpatient depressed young adults were impaired on the Wisconsin Card Sorting Task (WCST) because they were unable to maintain a set and displayed increased perseveration. Therefore, individuals who are depressed are more likely to have difficulties in being flexible in their recall of autobiographical memories.

Investigations into flexibility and depression have not focused on memory flexibility as a cognitive marker of either disease state or vulnerability for developing disease state. Flexibility is potentially important to examine because previous work in non-clinical samples investigating the use of the AMT as a vulnerability marker for developing depression and PTSD has shown that it is insensitive (Raes, Hermans, Williams & Eelen, 2007). Reasons for the lack of sensitivity may have included explicit and detailed instructions to retrieve a specific memory, practice sessions and repeated prompting to

retrieve a specific memory. There have been two further attempts to develop more sensitive measures. In particular, Raes et al (2007) developed a sentence completion version of the AMT (SCEPT) where participants completed open-ended sentences with autobiographical memories. The nature of the memories to be recalled was not specified to participants. Similarly, Debeer, Hermans, & Raes (2009) developed a minimal instructions AMT (MIN-AMT) where participants completed the AMT with minimal instruction versus full instructions. Both the SCEPT and MIN-AMT were more sensitive in detecting differences in non-clinical samples than the conventional AMT. Further, with the MIN-AMT, rumination was found to mediate the relationship between specific memory retrieval and depressed mood. This mediation effect had previously been observed only in clinically depressed patients (Raes, Hermans, Williams, Beyers, Eelen, & Brunfaut 2006). However both the SCEPT and the MIN-AMT do not assess the ability to flexibly retrieve memories. The requirement to flexibly retrieve memories places greater demands on executive functions of initiation and inhibition than the conventional requirement to retrieve a specific memory while also testing a new dimension of autobiographical memory retrieval that may have potential functional importance.

This is the first study to systematically manipulate and assess flexibility within a single assessment of autobiographical memory. On our novel measure, the Alternating Instruction Autobiographical Memory task (AMT-AI), participants were required to retrieve two types of memories, categoric or specific, to three set blocks of cue words. In two sets, the instructions were constant within set. In one set, participants were required to retrieve a specific memory (standard AMT: AMT-S condition). In the other set, they were instructed to retrieve a categoric memory (reversed AMT: AMT-R condition). For the final word block, participants were instructed to switch back and forth between retrieving first a categoric and then a specific memory, or vice versa, in the alternating instructions AMT (AMT-AI) condition.

Our first prediction was that the proportion of correct responses produced in the AMT-AI condition would be significantly lower than the proportion of correct responses produced in the AMT-S and the AMT-R conditions. This is because the latter two conditions do not involve switching between specific and categoric memories. Further predictions were that the proportion of specific memories retrieved would be significantly less for the specific only trials of the AMT-AI versus the AMT-S and that the proportion of categoric memories retrieved in the AMT-AI condition would be less than in the AMT-R condition. As the AMT-AI should place greater demands on executive functioning than the AMT-S and AMT-R respectively due to switching task demands, a further hypothesis was that the numbers of specific and categoric memories produced in the AMT-AI would be negatively correlated with depression symptomatology and total scores on the rumination scale. The effect of these relationships would be less for specific memories reported on the AMT-S, which is consistent with previous research (Debeer et al., 2009). Similarly the effects were predicted to be less for the categoric memories reported on the AMT-R. Finally, overall correct responses on the AMT-AI were predicted to negatively correlate with overall depression symptomatology and rumination scores.

Method

Participants

Forty-nine students from the University of St Andrews participated in the study. All participants were native English speakers and ranged in age from 18 to 30 years ($M = 22.29$, $SD = 1.83$). There were 13 males and 36 females.

Measures

Beck Depression Inventory II (BDI-II; Beck, Steer & Brown, 1996)—The BDI-II is a self-report measure of depressive symptom severity and consists of 21 items. Each item describes a specific depressive symptom that is rated on a 4-point scale where 0 indicates the absence of that symptom and 3 represents a very severe experience of the symptom. There is excellent evidence for the reliability and validity of the BDI-II. Internal consistency is high for both clinical (.92) and student populations (.93) (Beck, Steer & Brown, 1996).

Rumination Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991)—The RRS consists of 22 items that measure the participants' response to sadness (e.g. 'when I feel sad, I get absorbed in thinking about why I am sad and find it difficult to think about other things'). The items are rated on a 4-point scale ranging from 1 to 4. The RRS has sound reliability and validity (Treynor, Gonzalez, & Nolen-Hoeksema, 2003).

Alternating Instruction Autobiographical Memory Test (AMT-AI)—The AMT-AI is a computerized version of the AMT that consists of three blocks. The first block consists of six cue words that are used to elicit only specific memories (AMT-S condition). The second block also consists of six cue words that are used to elicit only categorical memories (reverse AMT (AMT-R condition)). The third block consists of 12 cue words where participants strictly alternate on every trial between retrieving specific and categorical memories (alternating instruction or AMT-AI). The type of memory retrieved in the first trial of the AI condition was counter-balanced across participants. All cue words were matched for frequency using the Medical Research Council (MRC) Psycholinguistic Database and the new Dictionary Affect in Language (DAL; Whissell, 2009) and there were equal number of positive, negative, and neutral cue words (See Appendix 1 for the full list of words). The words were randomized across blocks in order to minimize any effects of differential cue functioning (Heron, Crane, Gunnell, Lewis, Evans & Williams, 2012). The order of blocks was also randomized in order to control for order effects. Before the trials commenced, the experimenter explained the instructions for the task as well as provided definitions and examples of specific and categoric memories. The participants were then presented with three practice trials that used neutral cue words and the experimenter provided feedback on their performance to ensure that they understood the requirements of the task. For each of the 24 trials, instructions to retrieve either a specific or categoric memory appeared on the screen with the cue word (e.g., please retrieve a specific memory to the word happy).

Participants were not informed of the number of trials or the time limit to retrieve a memory, which was 60 seconds. If the participant failed to respond within 60 seconds a new

instruction and cue word appeared. The failure to respond was noted as an omission. The participants responded orally with their responses, which were digitally recorded by the experimenter and later used to calculate inter-rater reliability. The experimenter coded the memories during the experimental task.

For each autobiographical memory block, the proportion of correct responses was calculated as the number of correct responses in the block divided by the total number of possible responses in the block minus the number of omissions. Inter-rater reliability was calculated on fifty percent of the responses using Cohen's kappa (Cohen, 1968) and an experienced rater. The resultant Kappa coefficient was high ($K = .91$).

Procedure

Participants were tested individually. The autobiographical memory test was administered first, and then participants completed the BDI-II and the RRS questionnaires in a randomized order.

Statistical Analyses

A Kolmogorov-Smirnov normality check was conducted on the data and revealed violation of the normality assumption. Therefore, non-parametric statistics were used for all further analysis.

Results

Descriptive statistics

The mean BDI-II score was 9.37 ($SD = 6.87$; range 0-33) indicating minimal depressive symptom severity. The mean score on the RRS was 41.67 ($SD = 12.47$; range: 23-74).

Autobiographical memory results

Data were collapsed across word valence (positive, negative, neutral), as the sample size did not permit a meaningful analysis of valence effects.

Our first hypothesis was that the proportion of correct responses reported in the AMT-AI condition would be significantly lower than the proportion of correct responses reported in the AMT-S and AMT-R conditions. More correct responses occurred in the AMT-R (88.8%, $SD = 15.7$) condition than in the AMT-S (84.2%, $SD = 16.4$) and AMT-AI (82.6%, $SD = 13.4$) conditions, with the AMT-AI condition having the lowest correct number of responses. A Friedman's nonparametric test of the mean differences indicated that the observed difference across conditions was statistically significant ($\chi^2(49, 2) = 9.32, p < .01$). Non-parametric pairwise comparisons using the Wilcoxon-Signed rank test revealed that only the levels of performance between the AMT-R and the AMT-AI were statistically significant ($Z = -2.34$, $N - \text{Ties} = 27, p = .02$, two-tailed).

As the proportion of correct responses in the AMT-AI incorporated performance on both the categorical and specific trials, a further prediction was that there would be significantly lower levels of specific memories produced within the AMT-AI than in the AMT-S, and

also between the categorical memories in the AMT-AI and AMT-R conditions. The percentages of specific and categoric memories reported according to retrieval condition are shown in Table 1. The Wilcoxon sign rank test confirmed that the proportion of specific memories retrieved on the AMT-AI (76.49%, $SD=19.95$) was significantly lower than the proportion of specific memories retrieved on the AMT-S (84.2%, $SD=16.5$) ($Z=-2.25$, $N_{ties}=36$, $p=.03$, two-tailed). Performance between the proportions of categorical memories correctly retrieved in the AMT-AI (88.7%, $SD=12.58$) versus AMT-R (88.8%, $SD=15.7$) conditions was non-significant ($Z=-.53$, $N_{ties}=25$, $p=.59$, two-tailed). Additionally performance was compared on the proportion of correctly retrieved categoric and specific memories within the AMT-AI condition based on performance across all orders, which was not significantly different ($Z=-1.40$, $N_{ties}=24$, $p=.16$, two-tailed). Finally, performance for specific and categoric retrieval was compared only within the AMT-AI condition that came first. Specific retrieval was found to be poorer than categoric retrieval ($Z=-2.21$, 10 , $p=.03$), a pattern that differed from the overall sample. However, this finding was based only on data from 10 participants.

To evaluate if the effects were due to the condition order, we compared the trials where a block of categoric retrieval preceded the alternating instruction condition, the trials where a block of specific retrieval preceded the alternating instruction condition and the blocks where the alternating instruction condition were first. No differences were found among the three groups on overall performance on the mixed trials ($\chi^2(49, 2) = 1.37$, $p = .50$, performance on the alternating instruction specific only trials ($\chi^2(49, 2) = 1.08$, $p = .58$), nor on the alternating instruction categoric only trials ($\chi^2(49, 2) = .03$, $p = .99$). To determine if performance became worse within the alternating instruction conditions over time, we compared performance in the first six blocks to performance in the second six blocks. We found no significant differences due to order within the AMT-AI condition (Wilcoxon sign rank test $Z = -.63$, $N_{ties}=30$, $p = .53$).

Correlations between memory specificity, depression and rumination

A further prediction was that the level of autobiographical memory specificity as measured by the AMT-AI would be significantly negatively correlated with scores on the BDI-II and the RRS total score. Similarly, the level of categoric autobiographical on the AMT-AI, as opposed to the AMT-R, would be significantly negatively associated with BDI-II and RRS scores. However, the AMT-S and the AMT-R would not be as strongly related to these measures. As predicted, in the AMT-AI condition, the proportion of specific memories was significantly negatively correlated with BDI-II scores ($r_s(49)=-.28$, $p=.05$, two-tailed) and RRS ($r_s(49)=-.38$, $p < .01$, two-tailed), but no significant correlations were observed in the AMT-S. Additionally, the correlation between proportion of specific memories retrieved on the AMT-AI and RRS scores remained significant even after controlling for depression severity (see Table 1). The Steiger Z score for dependent correlations revealed that the correlations for BDI-II scores and specificity and the rumination scores and specificity were significantly different for the AMT-AI versus the AMT-S for the BDI-II (BDI-II: $Z=2.31$, $p < .01$ and a trend towards significance for the rumination scores (RRS: $Z = 1.16$, $p = .12$). As can be seen in Table 2, no significant correlations were found for either index of categoric retrieval. We also examined whether overall correct performance on the AI-AMT would be

negatively correlated with scores on the BDI-II and the RRS. The proportion of correct responses overall was significantly negatively correlated with BDI-II scores ($r(49) = -.24, p < .05$, one-tailed) and RRS scores ($r(49) = -.34, p < .05$, two-tailed). The correlation between overall success on the mixed trials and rumination remained significant after controlling for BDI-II scores ($r(46) = -.26, p < .03$, one-tailed).

Discussion

The present study investigated the utility of a new measure, the alternating instruction AMT (AMT-AI), for assessing flexibility in retrieving specific and categoric autobiographical memories. Our first hypothesis was that the proportion of correct memories retrieved for the alternating instruction autobiographical memory (AMT-AI) condition would be significantly less than the proportion of memories correctly retrieved in either the specific (AMT-S) or categoric (AMT-R) only conditions. The results partially confirmed this prediction and demonstrated that when participants had to follow one rule for retrieving categoric memories they performed better than in the alternating condition. Although not significant, there was a minimal difference in performance between the alternating condition relative to the specific only condition. Combined, these findings support prior evidence that specific retrieval is more difficult than categoric retrieval, and further affirms the generative memory retrieval framework (Williams et al., 2007). Overall, there appeared to be a gradient in the difficulty of retrieving autobiographical memories as a function of retrieval instructions, with the greatest impairment observed when there was higher cognitive demand due to the requirement to switch between retrieval rules.

A further prediction was that reduced accuracy would be found for specific retrieval under the alternating instruction condition as compared to the block specific retrieval condition, and for categoric retrieval under the alternating as opposed to the categoric block retrieval condition. However, our results demonstrated reduced accuracy in the alternating instruction as compared to the same instruction condition for specific but not categoric autobiographical memories. Thus, it seems that categoric retrieval was relatively unimpaired in the alternating instruction condition. One explanation could be the cognitive load associated with generative retrieval. In the alternating instruction condition, participants sequentially retrieved a specific and then categoric memory, or vice versa. As a particular context does not need to be retrieved for the categoric memory condition, the retrieval task is less demanding because the descriptions required for retrieval are more generic. Therefore, it would be easier to inhibit the previous inappropriate instruction in this context as opposed to the specific context, which placed greater demand on resources by requiring more detailed descriptions in order to retrieve a specific memory. Our findings suggested that errors in the alternating instruction specific trials were predominately categoric memories. The findings of Dalgleish et al (2007) on the reverse AMT are consistent with our findings; both studies found an approximate 10% error rate in the AMT-R condition. Interestingly, this error rate did not increase with the increased load of switching, indicating that the requirement to retrieve categoric memories is less resource demanding in this condition. Nonetheless, it is possible that varying the number of specific trials before a categoric memory trial might introduce increased cognitive load that would enable differences to appear on the categoric trials. Further differences on categoric retrieval using the present paradigm might be evident

in clinically depressed samples as their executive resources may be compromised by depression (McClintock et al., 2010; Snyder, in press) and might therefore show impaired performance.

A further finding in our study was that overall performance on the alternating instruction condition was negatively associated with rumination scores, and BDI-II scores, although latter association was weaker. The relationship with rumination remained after controlling for BDI-II scores. This overall performance is largely accounted for by performance on the specific trials in the alternating instruction condition. Autobiographical memory specificity was negatively associated with both depression severity and rumination scores on the alternating instruction condition, but not in the specific retrieval instruction condition. There were no relationships found for categoric retrieval performance in either the block or alternating instruction conditions. Even after controlling for levels of depression, the negative correlation between autobiographical memory specificity and rumination in the alternating condition remained significant although the magnitude of the correlation was not significantly different from the non-significant partial correlation between rumination and memory specificity generated on the AMT-S. A larger sample size may have found a more pronounced difference between the two correlations. As rumination has been found to be associated with perseveration errors (Whiter & Banish, 2006), perseveration could be accounting for why specific memory retrieval was more difficult following categoric retrieval. One possibility is that a categoric mode of responding would induce more ruminative thinking than a specific mode, and thus capture the more abstract mode of thinking. Our data suggested that the causal relationship between rumination and reduced memory specificity found in clinical samples (Watkins & Teasdale, 2001) extends to non-clinical samples, which is in line with findings by Debeer et al., 2009. However, this relationship in non-clinical samples can only be detected under conditions of high executive load. Our results suggest that priming individuals who are experiencing low mood to retrieve categoric memories may result in their perseveration on this retrieval style which subsequently impacts their ability to retrieve specific autobiographical memories. Targeting trait rumination in individuals seems to be important if flexibility in retrieving specific memories is to be improved.

There are some limitations associated with the current study. First, we deliberately chose to have just three conditions in this initial study, but future work could vary the number of trials of categoric and specific conditions. With our current study design we could provide no evidence for internal consistency or test-retest reliability as our items and blocks were randomized. Future research is needed to determine the internal consistency, test-retest reliability, and other psychometric properties of the AMT-AI in larger cohorts as well as the effects of cue words (Griffith, Klein, Sumner & Ehlers, 2012). Further, our study was cross-sectional. As highlighted by Debeer et al. (2009), a prospective study sequentially investigating first memory specificity on the AMT-AI at Time 1 followed by rumination at Time 2 and depressed mood at Time 3 would provide a useful design to examine the meditational effects of rumination. A future study with a larger sample size should also investigate how the separate components of rumination, brooding versus reflection, relate to performance on the AMT-AI. Another limitation was that we were unable to establish how performance on the AMT-AI corresponded to performance on other measures of

autobiographical memory such as the SCEPT or Min-AMT. Further prospective designs examining whether an index of retrieving autobiographical memories operating under shifting retrieval instructions would predict vulnerability for developing depression or PTSD in the future are warranted in order to determine if the AMT-AI is a useful vulnerability marker. Lastly, there was no assessment of a non-memory measure of cognitive flexibility or attention to determine whether the enhanced difficulty in retrieving specific memories under the alternating instruction set as opposed to the single instruction set was related to an executive function of flexibility, attention, or if it was specific to memory. One interesting feature of our data, however, is that in the switching trials, only specific retrieval was affected indicating that the difficulty in retrieving memories under shifting set instructions is selective.

In conclusion, our results clearly demonstrate that an important index of vulnerability may be the degree to which memory retrieval can operate flexibly. An advantage of the AMT-AI method over the Min-AMT (Debeer et al., 2009) is that the former focuses more explicitly on the ability to switch between the two key types of autobiographical memories, specific and categoric, which clinical research has identified as being different in depressed and non-depressed samples with important clinical ramifications (see Williams et al., 2007). A further point is that our data detected differences in a university student sample that presumably have relatively high levels of executive control. More pronounced effects, such as more difficulties in retrieving categoric as well as specific memory under alternating instructions set might be obtained in a more general population where there is more variation in levels of executive functioning. Our findings suggest that the ability to shift from one memory style to another may be a useful target for future assessment and training interventions. Indeed, future investigations are warranted to further develop and comprehensively characterize the psychometric properties of the AMT-AI.

Acknowledgments

This work was supported in part by grant MH087739 (PI: Shawn M. McClintock) from the National Institute of Mental Health (NIMH).

Appendix 1

Cue words

Appendix 1

Cue words

Positive	Negative	Neutral
Safe	Afraid	Nickname
Successful	Angry	Library
Surprised	Failure	Solution
Happy	Lonely	Vague
Calm	Worried	Practice
Energetic	Sad	Sea

Positive	Negative	Neutral
Comfortable	Hopeless	Baby
Loved	Sorry	Soul

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Table 1

Proportion of specific and categoric memories reported in each autobiographical memory retrieval condition

Retrieval Condition	AMT-Specific Retrieval Only	AMT-AI Alternating Instruction Specific retrieval	AMT-Categoric Retrieval Only	AMT-AI Alternating Instruction Categoric Retrieval
Specific %	84.21%	76.87%	1.32%	2.46%
Categoric %	4.91%	22.76%	88.84%	88.67%

AMT=Autobiographical Memory Test

Table 2
Bivariate and Partial correlations between AMT memory indices, depression and rumination

	AMT - S % specific memories		AMT-AI % specific memories)		AMT- R % categoric memories		AMT-AI % categoric memories		AMT-AI Overall correct responses	
	r	p	r	p	r	p	r	p	r	p
Spearman's correlation coefficient										
BDI-II	-.11	.46	-.28	.05 ²	.12	.40	-.02	.87	-.24	.05 ¹
RRS	-.04	.79	-.38	.01 ²	.18	.23	-.10	.51	-.34	.02 ²
Partial correlation controlling for BDI -II RSS	-.17	.23	-.29	.04 ²	.13	.38	-.11	.47	-.26	.05 ¹

AMT-S= Autobiographical memory test –specific retrieval only; AMT-AI=Autobiographical memory test-alternating instruction; AMT-R= Autobiographical memory test –reverse retrieval only; BDI-II=Beck Depression Inventory-Second Edition; RRS=Rumination Response Style Measure

¹ two-tailed
² one-tailed