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Autobiographical Memory Functions and Posttraumatic Stress Symptoms across Adulthood

Adriana del Palacio-Gonzalez, Lynn A. Watson, & Dorthe Berntsen

Center on Autobiographical Memory Research, Department of Psychology and Behavioural Sciences, Aarhus University, Denmark

Author Note

Adriana del Palacio-Gonzalez, delpalacio@psy.au.dk, (+45) 8716 5228; Lynn A. Watson, Lynn@psy.au.dk, (+45) 87165881; Dorthe Berntsen, dorthe@psy.au.dk, (+45) 8716 5868. Center on Autobiographical Memory Research, Department of Psychology and Behavioural Sciences, Aarhus University, Bartholins Allé 9, 1351-427, 8000 Arhus C, Denmark.

Correspondence concerning this article should be addressed to Adriana del Palacio-Gonzalez, Center on Autobiographical Memory Research, Department of Psychology and Behavioural Sciences, Aarhus University, Bartholins Allé 9, 1351-427, 8000 Arhus C, Denmark. Phone: +45 8716 5228, email: delpalacio@psy.au.dk.

Abstract

Previous research has documented robust individual differences in the functions served by autobiographical memories, and shown that different autobiographical memory functions are related to both positive and negative indicators of psychological well-being, and that their frequency varies with age. In this study, we examined the unique relationship between autobiographical memory functions and posttraumatic stress symptoms and whether such relationships varied with age across adulthood. A representative sample of 1040 adult Danes (20 to 70 years old) reported the frequency with which they recall autobiographical memories for different purposes as well as their level of posttraumatic stress disorder (PTSD) symptoms. Higher reflective and ruminative functions, as well as lower social function, predicted higher levels of posttraumatic stress symptoms. There were no moderating effects of age. The results suggest that although the frequency of various autobiographical functions varies throughout the adult years, their association with posttraumatic stress symptoms is similar across adulthood.

Keywords: autobiographical memory functions, PTSD, integrative model, lifespan development, psychological well-being

Autobiographical Memory Functions and Posttraumatic Stress Symptoms across Adulthood

Recalling personal events or thinking about personal memories serves various purposes, such as socializing and reflecting. Several models of autobiographical memory and reminiscing functions exist. The integrative approach to autobiographical memory functions (Harris, Rasmussen, & Berntsen, 2014) synthesizes two major theoretical models, namely, the three-function model (Bluck et al., 2005; Bluck & Alea, 2011), and the reminiscence functions model (Webster, 1993; 1997). The three-function model posits that there are three main autobiographical memory functions: social, directive, and self-continuity. This model is typically operationalized using the Thinking about Life Experiences Scale (TALE; Bluck et al., 2005; Bluck & Alea, 2011). The reminiscence functions model proposes eight functions; problem-solving, identity, death preparation, bitterness revival, boredom reduction, intimacy maintenance, conversation, and teach/inform (Webster, 1993; 1997) and is typically measured using the Reminiscence Function Scale (RFS; Webster, 1993; for a review of these and other function models, see Westerhof, Bohlmeijer, & Webster, 2010).

The integrative model defines four functions of autobiographical memory: social, generative, reflective, and ruminative (Harris et al., 2014). The social function of autobiographical memory refers to retrieving memories in order to support various social interactions, ranging from everyday conversation to forming deeper bonds with others. Thus, the social function of the integrative model correlates highly with the conversation and relationship nurturing functions of other models. The generative function refers to employing memories to create legacy and having a positive impact on the world. This function is closely related to the teaching, informing, and death preparation functions of the

reminiscence and three-function models (Bluck et al., 2005; Bluck & Alea, 2011; Webster, 1993; 1997). The reflective function is characterized by attention oriented to understanding one self and one's behaviours. It is related to other conceptualizations of autobiographical functions, including identity building, increasing a sense of self-continuity, as well as employing memories for problem-solving and directing behavior into the future. Finally, the ruminative function of the integrative model refers to self-focused attention, motivated by perceived losses and threats, and it is correlated to boredom reduction and bitterness revival of the reminiscence model (see Harris et al., 2014, for an extended account).

Autobiographical Memory Functions, Age, and Psychological Well-Being

The frequency with which functions of autobiographical memory are employed varies with age (Alea, Arneaud, & Ali, 2013; Alea, Bluck & Ali, 2015; Harris et al., 2014; Webster & Gould, 2007). Overall, younger adults report using autobiographical memories for a functional purpose more frequently than older individuals (Alea, et al., 2015; Wolf & Zimprich, 2015). In the integrative functions model, the reflective and ruminative functions are employed more frequently among younger adults than among older adults (Harris et al., 2014, Study 4). In contrast, the generative function is used more frequently among older individuals. The social function shows a small decline with age (i.e., slightly greater use among younger adults), however, it is the most frequently used function throughout adulthood (Harris et al., 2014, Study 4). These frequency variations across the life span are compatible with the findings from the reminiscence model (Webster, 1998; Alea et al., 2015, Bluck & Alea, 2009; Webster & McCall, 1999) and can be understood from a lifespan developmental framework. That is, thinking and talking about memories may serve different purposes across the lifespan (Rybash & Hrubí, 1997; Staudinger, 2001; Westerhof

et al., 2010). Because recalling autobiographical memories is related to an individual's goals and life tasks (Alea, Arneaud, & Ali, 2013; Bluck & Alea, 2009), and individuals have different goals and life-challenges across different stages of life, the functional ways in which people use their autobiographical memories in daily life may have different adaptive value at different ages (Wolf & Zimprich, 2015).

However, factors other than age are also related to the frequency with which the functions of autobiographical memory are employed. The purposes for which autobiographical memories are brought to mind are related to psychological well-being and mental health (Cappeliez, O'Rourke, & Chaudhury, 2005; Cappeliez & O'Rourke, 2006; O'Rourke, Cappeliez, & Claxton, 2011; Webster & McCall, 1999). Waters (2014) found that using memories more frequently for self, social and directive purposes was associated with a greater sense of purpose and value within the community and more positive social relationships. Grace, Dewhurst and Anderson (2016) found that higher levels of depressive symptoms in an undergraduate population were associated with more frequent thinking and less frequent talking about past life-events, and with more frequent use of memories for self-related, but not social or directive, functions. In a follow-up study, Grace et al., (2016) also found that individuals with higher levels of depressive symptoms found it less useful to talk about memories and less useful to use these memories for maintaining self-continuity. Together, these studies indicate that the frequency of different autobiographical memory functions is informative of an individual's psychological well-being.

With the exception of Waters (2014) and Grace et al., (2016), who assessed the three-function model in relation to psychological well-being, the majority of research investigating memory function and psychological well-being extends from the

reminiscence model. Boredom reduction and bitterness revival are related to higher anxiety, depressive symptoms, and general distress (Cappeliez et al., 2005; Cully, LaVoie, & Gfeller, 2001) and with lower happiness, life satisfaction, and well-being (Cappeliez et al., 2005; Cappeliez & O'Rourke, 2006; Webster & McCall, 1999). Similarly, the intimacy maintenance function is related to greater psychological distress (Cappeliez et al., 2005) and lower wellbeing (Cappeliez & O'Rourke, 2006) among older adults. In contrast, teaching and conversation functions are generally related to higher levels of happiness (Webster, 1998; Webster & McCall, 1999). Evidence regarding the relationship between other reminiscence functions and psychological functioning is more mixed. For instance, in two studies with older adults, death preparation was related to both greater anxiety (Cully et al., 2001) and greater wellbeing (Cappeliez & O'Rourke, 2006).

With few exceptions (e.g., O'Rourke, et al., 2011), the majority of studies examining autobiographical memory or reminiscence functions in relation to psychological well-being have focused either on older adults (typically 60 years old or older) (Cully et al., 2001; Cappeliez et al., 2005; Cappeliez & O'Rourke, 2006; Ros et al., 2016; Webster, 1998) or undergraduate student samples (Waters, 2014; Grace et al, 2016). However, whether or how the relationship between autobiographical memory functions and psychological symptoms varies across different stages of adulthood has not been thoroughly examined. To our knowledge, no studies have examined the relationship between the integrative model's four functions and symptoms of psychological distress in general, and in relation to posttraumatic stress disorder (PTSD) symptoms, in particular.

Some PTSD symptoms reflect a direct relationship between autobiographical memory and psychological suffering, such as experiencing distressing memories of

stressful events (e.g., repeated unwanted negative memories), and avoiding reminders of a stressful event (American Psychological Association, 2013; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). Importantly, individuals may experience PTSD-like symptoms or posttraumatic stress symptoms (PTSS) in relation to negative, non-traumatic events (Cameron, Palm & Follette, 2010; Fitzgerald, Berntsen, & Broadbridge, 2016; Rubin, Berntsen, & Bohn, 2008), which are sometimes greater than the symptoms associated with traumatic events (Gold, Marx, Soler-Baillo, & Sloan, 2005; Rubin et al., 2008). Therefore, assessing how memory processing relates to symptoms of PTSD (or PTSS) has become an important research area. Previous research suggests that increased symptoms of PTSD are associated with changes in the characteristics of autobiographical memories more broadly, including characteristics of negative, positive, important and word-cued memories (Rubin, Boals & Berntsen, 2008; Rubin, Dennis & Beckham, 2011). However, the relationship between the function of autobiographical memories and symptoms of PTSD (or PTSS) remains to be examined.

Autobiographical Memory Functions, Coping, and Posttraumatic Stress

While research investigating the relationship between autobiographical memory functions and PTSD symptoms is lacking, the ruminative, reflective, and social functions of autobiographical memory do share some features with different coping strategies that are potentially related to the elevation of, or protection against, PTSD symptoms. For instance, the ruminative and reflective functions of autobiographical memory are conceptually related to trait-like tendencies towards rumination and reflection; two cognitive processing styles that may be conceptualized as cognitive coping strategies for negative events (Aldao & Nolen-Hoeksema, 2010). In studies of individuals experiencing posttraumatic stress

disorder (PTSD), rumination has often been defined as repeatedly thinking about a trauma and/or its consequences (Ehring, Frank, & Ehlers, 2008). Both ruminating about specific events and the trait-like variant are related to greater PTSD symptoms (Ehring et al., 2008; Ehring & Ehlers, 2014; Morina, 2011). Rumination also predicts PTSD symptoms prospectively (Ehring et al., 2008, Study 2), thus suggesting a role in the maintenance of symptom severity. Research on the relationship between reflection and PTSD symptoms is minimal. However, evidence for depressive and anxiety symptoms suggests that the relationship between trait-like reflection and psychological symptoms is not straightforward (Aldao & Nolen-Hoeksema, 2010; Treynor, Gonzalez, Nolen-Hoeksema, & 2003; Whitmer & Gotlib, 2011). Different factors may have an impact on the relationship between reflection and distress symptoms, including the severity of the symptoms and diagnostic status (Whitmer & Gotlib, 2011), and their overlap with rumination (Aldao & Nolen-Hoeksema, 2010).

Previous research supports the view that trait-like tendencies towards rumination and reflection are related to, but are also different from, the ruminative and reflective functions of autobiographical memory (for example, correlations were moderate, $r_s = .37$ to $.40$, in Harris et al., 2014, Study 2). Here we conceptualize these constructs as interconnected, but yet different, inasmuch as the ruminative and reflective functions of autobiographical memory refer to a conscious judgment of why memories are employed, whereas trait-based rumination and reflection are broader cognitive processes that reflect a general and habitual tendency for responding to low mood or stressful life events (i.e., as cognitive coping or emotion regulation strategy; Aldao & Nolen-Hoeksema, 2010) with

abstract evaluative thoughts, which may or may not involve the retrieval of memories (see Ehring & Watkins, 2008).

In a similar vein, the social function of autobiographical memory may be related to the employment of social support as a coping strategy. Social support is a multidimensional construct (Ostberg & Lennartsson, 2007; Semmer, Elfering, Jacobshagen, Perrot, Beehr, & Boos, 2008). One such dimension is emotional support (i.e., listening, validating, empathizing) which occurs through the communication of life events (Morelli, Lee, Arnn, & Zaki, 2015; Ostberg, & Lennartsson, 2007). As such, social support may involve sharing the personal past in the form of memories. High levels of social support has been found to have a negative correlation with PTSD symptoms in a variety of populations (Crevier, Marchand, Nachar, & Guay, 2014; Ozer et al., 2003; Ozer & Weiss, 2004; Shallcross, Arbsi, Polusny, Kramer, & Erbes, 2016). This negative relationship may reflect either a buffering effect of social support against PTSD symptoms or the deterioration of social relationships (i.e., low social support) during the presence of high PTSS (Shallcross et al., 2016). However, it is not known whether such negative relationship with PTSS is also present in the use of memories for a social function.

Current Study

The purpose of the present study was to examine the relationship between autobiographical memory functions and PTSS across the life span, thereby starting to fill a gap in the literature. Based on previous research demonstrating age-related differences in autobiographical memory functions (Alea et al., 2015; Harris et al., 2014; Webster & Gould, 2007) and the current lack of research investigating the functions of the integrative model in relation to PTSS, the main objective of this study was to examine whether any of

the four autobiographical memory functions of the integrative model would be related to PTSS severity, and whether such relationships would show a different pattern at different stages in adulthood.

The present study was partly exploratory. Our hypotheses were limited to the relation between memory functions and PTSS. We had no specific hypotheses as to whether these relationships would interact with age. First, previous studies have found that more reminiscing and talking about personal memories is related to higher emotional distress symptoms, such as depression and anxiety (e.g., Cappeliez et al., 2005; Grace et al., 2016). Thus, we expected to replicate this positive relationship for both the ruminative and reflective functions and PTSS. However, in light of previous findings with the social (e.g., Grace et al., 2016) and teaching (e.g., Webster & McCall, 1999) functions, we expected weaker or no relationship between the social and generative functions and PTSS. Second, we expected the ruminative function to be a unique predictor of PTSS across adulthood. This prediction was based on findings that the ruminative function of autobiographical memory is associated with negative memories in adults of all ages (Harris et al., 2014, Study 3), and on evidence that ruminative coping, more broadly, is associated with PTSD symptoms (Ehring & Ehlers, 2014; Morina, 2011). Third, we expected that PTSS severity would be higher among younger adults and decrease with age (e.g., de Vries, & Olf, 2009).

In addition, we conducted exploratory analyses to examine whether the relationships between autobiographical memory functions and PTSS would interact with age. In order to investigate the specific relationship of the memory functions to PTSS, as opposed to more general psychological distress, we controlled for depressive symptoms, which are

moderately to highly correlated to PTSD symptoms (e.g., Schindel-Allon, Aderka, Shahar, Stein, & Gilboa-Schechtman, 2010).

Method

Participants

A total of 1040 individuals from the community (50.2% female, $n = 522$) ages 20-70 ($M = 45.97$, $SD = 14.26$) took part. Data derive from the same data collection reported in Harris et al. (2014). Data were collected online by TNS Gallup (a market research agency) in Denmark to obtain a representative sample of Danes stratified by age, gender, geographic region, and education level.

Materials

Functions of autobiographical memories questionnaire (FAME; Harris, et al., 2014). This questionnaire consists of 32 items assessing the frequency of use of autobiographical memories. The FAME yields four factors, each assessing one function of autobiographical memory: reflective (e.g., “*When I am concerned about whether my beliefs have changed over time*” and “*When I need to make a life choice and I am uncertain which path to take*”), social (e.g., “*Because it promotes fellowship and a sense of belonging*” and “*When I want to help someone by telling them about my own past experiences*”), ruminative (e.g., “*For lack of any better mental stimulation*” and “*To keep memories of old hurts fresh in my mind*”), and generative (e.g., “*In order to leave a legacy of family history*” and “*Because I feel less fearful of death after I finish reminiscing*”). The items and the four-factor solution have been previously supported (Harris et al.'s 2014; Study 1 and Study 4). In the current study, the items followed the sentence stem “I think about or talk to other people about my memories ...” and were answered on a five-point Likert scale

ranging from 1 = *almost never* to 5 = *very often*. The internal consistency for the full scale in the current sample was high, $\alpha = .92$. The internal consistency was .76, .84, .86, and .88, for the Ruminative, Generative, Social, and Reflective subscales, respectively.

The posttraumatic stress disorder checklist – civilian version (PCL-C; Blanchard, et al., 1996). The PCL-C is a 17-item questionnaire used to assess the presence and severity of symptoms of posttraumatic stress disorder. When answering the PCL, participants were asked to respond to the questionnaire items while thinking about “their most stressful experience which may have caused them problems in the last month.” Response items go from 1 = *Not at all* to 5 = *Extremely*. The internal consistency in the current sample was excellent, $\alpha = .94$.

The center for epidemiologic studies – depression scale (CES-D; Radloff, 1977). The CES-D is a 20-item measure screening for symptoms of depression over the past week. The response options go from 0 = *Rarely/None* to 3 = *Most/All of the time*. The internal consistency in the current sample was high, $\alpha = .86$.

Demographic data regarding sex, age, and educational level were also collected.

Results

Data Analysis Strategy

Participants were divided into four age groups (1 to 4) to allow for direct comparison with the age quartiles reported by Harris et al., (2014) as follows: 20-33, 34-45, 46-58, and 59 to 70. To test the first two hypotheses, we examined the relationship between PTSS and age, as well as PTSS and the functions in simple correlations. Later, a multiple hierarchical regression was conducted, employing posttraumatic stress symptoms (PCL-C scores) as the dependent variable to examine the unique relationships between each

function and PTSS. In this hierarchical regression model, sex and age group were entered in Step 1. Step 2 controlled for depressive symptoms to increase the specificity of our analyses to PTSS as opposed to general psychological distress. The four autobiographical memory functions were entered together in Step 3. In so doing, the shared variance across the four functions (i.e., frequency of thinking of memories) was controlled and allowed us to examine the unique PTSS variance explained by each function. Lastly, the interactions of age group x autobiographical functions were entered in the last step (with mean-centered variables).¹

Descriptive Statistics and Simple Correlations

Demographic characteristics as well as the means and *SDs* for the autobiographical memory functions and PTSS and depressive symptoms are reported in Table 1 for each age group. Fourteen percent of the full sample ($n = 150$) scored equal to, or greater than 44, in the PCL-C, which is the recommended cut-off for clinical severity of PTSD symptoms (Blanchard et al., 1996). The age of these 150 participants ranged from 20 to 70 ($M = 43.93$, $SD = 14.59$), and 55% ($n = 82$) were women.

Correlations between age, symptoms, and functions. As observed in Table 2, for the full sample, all four functions had a positive correlation with PTSS. Thus, the higher frequency of the ruminative, reflective, social, and generative functions, the higher the PTSS. Further, age had a negative correlation with PTSS and with the reflective, ruminative, and social functions so that the younger the individuals, the greater the PTSS severity, and the greater the frequency of the three aforementioned autobiographical memory functions. (Note that the age and memory function relationship for this sample was previously reported by Harris et al., 2014, Study 4).

Prediction of PTSS Severity

The final regression model (Step 4) was significant, $F(11,1028) = 23.44$, $R^2 = .20$, $p < .001$ (see Table 3). Younger age was predictive of more PTSS in Step 1. As expected, higher depressive symptoms also predicted higher PTSS in Step 2. Regarding the functions, in Step 3, greater reflective and ruminative functions predicted more PTSS, with small and moderate effect sizes, respectively. In contrast, a lower social function predicted higher symptoms level, with a small effect size. Step 4, containing the interactions of age by function, was non-significant. In the final model (Step 4), greater depressive symptoms, greater ruminative and reflective functions, and lower social function, remained significant as unique predictors of greater PTSS. A moderating effect of age on the relationship between the functions and PTSS was not supported.

Discussion

The purposes with which individuals think or talk about their past is associated with psychological well-being (e.g., Cappeliez et al., 2005). Previous work has shown that elevated PTSD symptoms are associated with changes in a number of autobiographical memory characteristics (Rubin, et al., 2008; Rubin, et al., 2011), but functions of autobiographical memory have not been directly examined in relation to PTSD symptoms.

In the current study, based on a large representative sample, we found that autobiographical memory functions were differentially associated with increased posttraumatic stress symptoms (PTSS). We found that all four autobiographical functions of the integrative model (i.e., social, ruminative, reflective, and generative functions; Harris et al., 2014) were positively associated with PTSS. Although these findings were consistent with our expectation regarding a relationship between PTSS and the ruminative and

reflective functions, the positive relation with the generative and social functions were unexpected. This pattern may suggest that a generally high frequency of recalling autobiographical memories, rather than the specific purpose with which they are recalled, is associated with greater PTSS. This agrees with findings showing that the frequency of engaging in remembering one's past and imagining one's future is positively related to PTSD symptoms and other measures of emotional distress (Berntsen, Rubin & Salgado, 2015).

However, once such general variance was accounted for, we found that the specific functions had different and unique relationships with PTSS. Specifically, we found that an increased usage of autobiographical memories for ruminative purposes predicted PTSS. The same was true for the reflective function, albeit with smaller effects. In contrast, the social function was negatively related to PTSS, and the generative function was not uniquely associated with PTSS.

The finding that a greater ruminative usage of autobiographical memories predicted higher PTSD symptoms is consistent with evidence that memory functions, such as boredom reduction and bitterness revival, which are aspects of the ruminative function (Harris et al., 2014), are generally related to negative psychological outcomes (e.g., Cappeliez et al., 2005; Cully et al., 2001). A couple of explanations for this relationship are possible. First, because the ruminative function of autobiographical memory is more frequently employed in relation to negative memories (Harris et al., 2014), the positive relationship between the ruminative function and PTSS may simply reflect that individuals, who more easily access personal memories of negative events, experience elevated PTSS. Alternatively, individuals with increased PTSS may more frequently engage in a

dysfunctional coping style, characterized by a tendency to focus on, or think about memories to influence their negative mood.

These two explanations are not mutually exclusive, but may complement one another. In two studies of assault survivors, Michael, Halligan, Clark and Ehlers (2007) found that almost 90% individuals with a diagnosis of PTSD ruminated about the traumatic event experienced and its consequences, and that rumination about traumatic events was associated with increased symptom severity. Furthermore, these individuals also more frequently identified rumination as a trigger for intrusive memories about the traumatic event and used rumination more frequently as a means of stopping thinking about intrusive memories, suggesting that individuals with PTSD also more frequently engage in rumination as a maladaptive coping style.

The positive relationship between the reflective function and PTSS may also be explained by the different aspects of this autobiographical memory function, and how they relate to distress. For instance, one aspect of the reflective function is identity building or consolidation (Harris et al., 2014), which may be expected to be reached during late adolescence or early adulthood (Habermas & Bluck, 2000). Speculatively, once adulthood is entered, a positive relation between the reflective function and PTSD symptoms may reflect dissatisfaction or confusion with one's own identity, at a life stage when identity consolidation is expected to be complete. Another aspect of the reflective function is using memories with the purpose of directing one's behavior in relation to planning and preparing for the future (Harris et al., 2014). Accordingly, the positive relationship between the reflective function and PTSD may indicate worries about the future or consequences of past events that have to be dealt with in the future (Cully et al., 2001).

Using autobiographical memories for social purposes was negatively associated with PTSS, when controlling for the other function measures. One parsimonious explanation for this finding is that the social bonding achieved through sharing memories in personal relationships may protect individuals against PTSD symptoms by providing them with a source for coping, following negative or stressful events (Shallcross et al., 2016). A second possibility is that the individuals with fewer symptoms (i.e., less distress) are more likely to share personal memories, or use their memories for social transactions, more frequently than more distressed individuals.

Regarding age, we found that posttraumatic stress symptoms were related to younger age, thus replicating previous studies on PTSD and age (e.g., de Vries & Olf, 2009). Furthermore, similar to previous studies on other autobiographical memory functions (e.g., Alea et al., 2015; Harris et al., 2014; Webster & McCall, 1999) younger age was related to a greater use of the reflective, ruminative, and social functions, and lower generative function in simple correlations. However, we found no evidence that the relationship between the frequency of autobiographical memory functions and level of PTSS varied with age across adulthood. That is, the relationships between memory functions and PTSS did not interact with the age of the participants.

Recalling personal memories may serve goals that are specific to the developmental stage of the individual (Rybash & Hrubí, 1997; Staudinger, 2001; Westerhof et al., 2010). This may explain why the frequency of memory functions varied across adulthood in the present study. For instance, according to the socioemotional selectivity theory (Carstensen et al., 1999; Carstensen, 2006), individuals develop expertise in regulating their emotions as they grow older, and thus may retrieve personal memories for ruminative or reflective

functions less frequently. However, even though the functions of autobiographical memory retrieval may change as we get older, our findings suggest that when memories are indeed retrieved for one purpose (i.e., ruminative) or another (i.e., social), the mechanisms linking them to PTSS are similar across adulthood. In the present study, this may explain why a more frequent retrieval of memories for ruminative and reflective functions was associated with greater PTSS, irrespective of age, while the reverse association was found for the social function across age group.

When interpreting the findings, several cautionary notes should be made. First, the effects for both the reflective and social functions were small. Furthermore, the social function showed a positive bivariate correlation with PTSS that turned negative in the regression analysis. This result may be explained by the removal of the shared variance across the four functions when entering them together in the regression analysis. Specifically, the (weak) positive correlation between the social function and PTSS may reflect that a general tendency for reminiscing is related to higher PTSS. This is consistent with the fact that all four function scores had positive correlations to PTSS.

Second, when evaluating the findings, it is important to consider that the majority of participants (86%) did not report severe PTSS. The present study therefore leaves unresolved whether age would modify the relation between autobiographical memory functions and PTSD symptoms in more severely distressed populations.

Third, the present study only included participants who were 70 years old and younger. It is therefore unclear whether age would moderate the relation between function measures and PTSS in a sample including older participants. Few studies have examined autobiographical memory functions in adults older than 70 years of age. In one study,

Cappeliez and O'Rourke (2006) found that retrieving memories for boredom reduction and bitterness revival purposes was related to lower life satisfaction among adults aged 50 to 84. In another study (Boals, Hayslip, & Banks, 2014), thinking and talking more about negative memories were related to increased PTSS to a similar extent among both older (ages 60 to 93) and younger adults (ages 18 to 29). Therefore, it is possible that our findings extend to even older adults, which is a question for future research.

Fourth, another limitation of the present study is that the findings are based on self-report questionnaires, which may be susceptible to reporting biases. Fifth, the data are correlational. Therefore, we cannot clarify in which direction PTSS and memory functions affect one another. Sixth, previous studies indicate that the frequency with which different functions are engaged is related to the valence (i.e., positive or negative) of memories (Harris et al., 2014). The FAME is a general measure of the use of autobiographical memory functions that does not require focusing on specific memories. However, assessing the general tendency for individuals to retrieve memories of one or another valence would be helpful in clarifying the role of the functions in connection with PTSD symptoms. Finally, we focused on PTSD symptoms and the present study therefore leaves unresolved how autobiographical memory functions are associated with other groups of symptoms of psychopathology.

In sum, the present study adds to the growing literature on how autobiographical memory processing is related to PTSD symptoms and other indices of psychological well-being. Specifically, the ruminative and reflective functions of autobiographical memory were related to greater PTSS, whereas the social function was related to lower PTSS. These relationships were not statistically different across different ages during adulthood,

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thus suggesting that these associations are independent of cognitive and (or) emotional processes that change with aging.

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Disclosure of Interest

The authors report no conflicts of interest.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Aldao, A., & Nolen-Hoeksema, S. (2010). Specificity of cognitive emotion regulation strategies: A transdiagnostic examination. *Behaviour Research and Therapy*, 48(10), 974-983.
- Alea, N., Arneaud, M. J., & Ali, S. (2013). The quality of self, social, and directive memories: Are there adult age group differences? *International Journal of Behavioral Development*, 37(5), 395-406.
- Alea, N., Bluck, S., & Ali, S. (2015). Function in context: Why American and Trinidadian young and older adults remember the personal past. *Memory*, 23, 55-68.
- Berntsen, D. & Rubin, D. C. (2007). When a trauma becomes a key to identity: Enhanced integration of trauma memories predicts posttraumatic stress disorder symptoms. *Applied Cognitive Psychology*, 21, 417-431.
- Berntsen, D., Rubin, D.C. & Salgado, S. (2015). The frequency of involuntary autobiographical memories and future thoughts in relation to daydreaming, emotional distress, and age. *Consciousness & Cognition*, 36, 352-372.
- Boals, A., Hayslip, B., Jr., & Banks, J. B. (2014). Age differences in autobiographical memories of negative events. *The International Journal of Aging & Human Development*, 78(1), 47-65.
- Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy*, 34(8), 669-673.

- Bluck, S., Alea, N., Habermas, T., & Rubin, D. C. (2005). A TALE of three functions: the self-reported uses of autobiographical memory. *Social Cognition*, 23, 91-117.
doi:10.1521/soco.23.1.91.59198
- Bluck, S., & Alea, N. (2011). Crafting the TALE: Construction of a measure to assess the functions of autobiographical remembering. *Memory*, 19(5), 470-486.
- Bluck, S., & Alea, N. (2009). Thinking and talking about the past: Why remember? *Applied Cognitive Psychology*, 23(8), 1089-1104.
- Cameron, A., Palm, K., & Follette, V. (2010). Reaction to stressful life events: What predicts symptom severity? *Journal of Anxiety Disorders*, 24(6), 645-649.
- Cappeliez, P., & O'Rourke, N. (2006). Empirical validation of a model of reminiscence and health in later life. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, 61(4), P237-P244.
- Cappeliez, P., O'Rourke, N., & Chaudhury, H. (2005). Functions of reminiscence and mental health in later life. *Aging & Mental Health*, 9(4), 295-301.
- Cappeliez, P., & O'Rourke, N. (2006). Empirical validation of a model of reminiscence and health in later life. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, 61B(4), P237-P244.
- Carstensen, L. L. (2006). The influence of a sense of time on human development. *Science*, 312 (5782), 1913-1915.
- Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist*, 54(3), 165-181.

- Cohen, G. (1998). The effects of aging on autobiographical memory. *Autobiographical memory: Theoretical and applied perspectives*. (pp. 105-123) Lawrence Erlbaum Associates Publishers, Mahwah, NJ. Retrieved from
- Crevier, M. G., Marchand, A., Nachar, N., & Guay, S. (2014). Overt social support behaviors: Associations with PTSD, concurrent depressive symptoms and gender. *Psychological Trauma: Theory, Research, Practice, and Policy*, 6(5), 519-526.
- Cully, J. A., LaVoie, D., & Gfeller, J. D. (2001). Reminiscence, personality, and psychological functioning in older adults. *The Gerontologist*, 41(1), 89-95.
- de Vries, G., & Olf, M. (2009). The lifetime prevalence of traumatic events and posttraumatic stress disorder in the Netherlands. *Journal of Traumatic Stress*, 22(4), 259-267.
- Ehring, T., & Ehlers, A. (2014). Does rumination mediate the relationship between emotion regulation ability and posttraumatic stress disorder? *European Journal of Psychotraumatology*, 5.
- Ehring, T., Frank, S., & Ehlers, A. (2008). The role of rumination and reduced concreteness in the maintenance of posttraumatic stress disorder and depression following trauma. *Cognitive Therapy and Research*, 32, 488-506.
- Ehring, T., & Watkins, E. R. (2008). Repetitive negative thinking as a transdiagnostic process. *International Journal of Cognitive Therapy*, 1(3), 192-205
- Erikson, E. H. (1997). *The life cycle completed. Extended version with new chapters on the ninth stage of development by Joan M. Erikson* W. W. Norton & Co., 500 Fifth Avenue, New York, NY 10110.

- Fitzgerald, J. M., Berntsen, D., & Broadbridge, C. L. (2016). The influences of event centrality in memory models of PTSD. *Applied Cognitive Psychology, 30*(1), 10-21.
- Gold, S. D., Marx, B. P., Soler-Baillo, J., & Sloan, D. M. (2005). Is life stress more traumatic than traumatic stress? *Journal of Anxiety Disorders, 19*, 687-698.
- Grace, L., Dewhurst, S. ., & Anderson, R. J. (2016) A dysphoric's TALE: The relationship between the self-reported functions of autobiographical memory and symptoms of depression, *Memory, 24*(9) 1173-1181
- Harris, C. B., Rasmussen, A. S., & Berntsen, D. (2014). The functions of autobiographical memory: An integrative approach. *Memory, 22*, 559-581.
- Michael, T., Halligan, S. L., Clark, D. M., & Ehlers, A. (2007). Rumination in posttraumatic stress disorder. *Depression and Anxiety, 24*(5), 307-317.
- Morelli, S. A., Lee, I. A., Arnn, M. E., & Zaki, J. (2015). Emotional and instrumental support provision interact to predict well-being. *Emotion, 15*(4), 484-493.
- Morina, N. (2011). Rumination and avoidance as predictors of prolonged grief, depression, and posttraumatic stress in female widowed survivors of war. *Journal of Nervous and Mental Disease, 199*, 921-927.
- O'Rourke, N., Cappeliez, P., & Claxton, A. (2011). Functions of reminiscence and the psychological well-being of young-old and older adults over time. *Aging & Mental Health, 15*(2), 272-281.
- Ostberg, V., & Lennartsson, C. (2007). Getting by with a little help: The importance of various types of social support for health problems. *Scandinavian Journal of Public Health, 35*, 197-204.
- Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic

- stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin*, 129, 52-73.
- Ozer, E. J., & Weiss, D. S. (2004). Who develops posttraumatic stress disorder? *Current Directions in Psychological Science*, 13, 169-172.
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1(3), 385-401.
- Ros, L., Meléndez, J. C., Webster, J. D., Mayordomo, T., Sales, A., Latorre, J. M., & Serrano, J. P. (2016). Reminiscence Functions Scale: Factorial structure and its relation with mental health in a sample of Spanish older adults. *International Psychogeriatrics*, 28(9), 1521-1532.
- Rubin, D. C., Boals, A., & Berntsen, D. (2008). Memory in posttraumatic stress disorder: Properties of voluntary and involuntary, traumatic and nontraumatic autobiographical memories in people with and without posttraumatic stress disorder symptoms. *Journal of Experimental Psychology: General*, 137(4), 591-614.
- Rubin, D. C., Dennis, M. F., & Beckham, J. C. (2011). Autobiographical memory for stressful events: The role of autobiographical memory in posttraumatic stress disorder. *Consciousness and Cognition*, 20(3), 840-856.
- Rybash, J. M., & Hrubí, K. L. (1997). Psychometric and psychodynamic correlates of first memories in younger and older adults. *The Gerontologist*, 37(5), 581-587.
- Semmer, N. K., Elfering, A., Jacobshagen, N., Perrot, T., Beehr, T. A., & Boos, N. (2008). The emotional meaning of instrumental social support. *International Journal of Stress Management*, 15(3), 235-251.

Schindel-Allon, I., Aderka, I. M., Shahar, G., Stein, M., & Gilboa-Schechtman, E. (2010).

Longitudinal associations between post-traumatic distress and depressive symptoms following a traumatic event: A test of three models. *Psychological Medicine*, 40(10), 1669-78.

Shallcross, S. L., Arbisi, P. A., Polusny, M. A., Kramer, M. D., & Erbes, C. R. (2016).

Social causation versus social erosion: Comparisons of causal models for relations between support and PTSD symptoms. *Journal of Traumatic Stress*, 29(2), 167-175.

Staudinger, U. M. (2001). Life reflection: A social-cognitive analysis of life review.

Review of General Psychology, 5(2), 148-160.

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A

psychometric analysis. *Cognitive Therapy and Research*, 27(3), 247-259.

Waters, T. E. A. (2014). Relations between the functions of autobiographical memory and

psychological wellbeing, *Memory*, 22(3), 265-275.

Webster, J. D. (1993). Construction and validation of the reminiscence functions scale.

Journal of Gerontology, 48(5), P256-P262.

Webster, J. D. (1997). The Reminiscence Functions Scale: A replication. *The International*

Journal of Aging and Human Development, 44, 137-148.

Webster, J. D. (1998). Attachment styles, reminiscence functions, and happiness in young

and elderly adults. *Journal of Aging Studies*, 12(3), 315-330

Webster, J. D., & Gould, O. (2007). Reminiscence and vivid personal memories across

adulthood. *The International Journal of Aging and Human Development*, 64, 149-170.

Webster, J. D., & McCall, M. E. (1999). Reminiscence functions across adulthood: A

replication and extension. *Journal of Adult Development*, 6(1), 73-85.

Westerhof, G. J., Bohlmeijer, E., & Webster, J. D. (2010). Reminiscence and mental health:

A review of recent progress in theory, research and interventions. *Ageing & Society*, 30(4), 697-721.

Whitmer, A., & Gotlib, I. H. (2011). Brooding and reflection reconsidered: A factor

analytic examination of rumination in currently depressed, formerly depressed, and never depressed individuals. *Cognitive Therapy and Research*, 35(2), 99-107.

Wolf, T., & Zimprich, D. (2015) Differences in the use of autobiographical memory across the adult lifespan, *Memory*, 23(8), 1238-1254.

Table 1

Mean (Standard Deviation) of Main Variables for Each Age Group

	Age 1 (20 – 33)	Age 2 (35 – 45)	Age 3 (46-58)	Age 4 (59-70)
<i>N</i>	247	258	271	264
Age	27.31 (3.72)	38.71 (3.23)	51.98 (3.75)	64.37 (3.18)
Females %	51.4	50.8	48.7	50.0
PCL-C	31.06 (13.35)	30.69 (14.72)	29.04 (11.86)	28.80 (11.98)
CES-D	6.20 (3.05)	6.38 (3.46)	5.86 (2.71)	5.89 (2.93)
Reflective	2.94 (0.69)	2.81 (0.73)	2.53 (0.73)	2.39 (0.73)
Ruminative	2.20 (0.57)	2.09 (0.57)	1.98 (0.54)	1.98 (0.54)
Generative	1.94 (0.62)	2.20 (0.63)	2.28 (0.62)	2.43 (0.66)
Social	3.09 (0.64)	2.93 (0.63)	2.78 (0.64)	2.73 (0.70)

Note. CES-D = Center for Epidemiologic Studies – Depression Scale. PCL-C =

Posttraumatic Stress Disorder Checklist-Civilian.

Table 2

Simple Correlations between the Primary Variables

		2	3	4	5	6	7	<i>M (SD)</i>
1	PCL-C	.30**	-.07*	.25**	.33**	.15**	.12**	29.87 (13.02)
2	CES-D		-.05	.13**	.11**	.05	.07*	6.07 (3.05)
3	Age group			-.29**	-.15**	.26**	-.20**	2.53 (1.11)
4	Reflective				.58**	.45**	.62**	2.66 (0.75)
5	Ruminative					.47**	.55**	2.06 (0.56)
6	Generative						.40**	2.22 (0.66)
7	Social						--	2.88 (0.67)

Note. $N = 1040$. CES-D = Center for Epidemiologic Studies – Depression Scale; PCL-C =

Posttraumatic Stress Disorder Checklist-Civilian.

* $p < .05$. ** $p < .01$.

Table 3

Prediction of Posttraumatic Stress Symptoms by Age and

Autobiographical Memory Functions

	Posttraumatic Stress Symptoms (PCL-C)			
	ΔR^2	β	<i>t</i>	<i>sr</i> ²
Step 1	.01*			
Sex		0.06	1.77	<.01
Age Group		-0.07	-2.31*	.01
Step 2	.09***			
Sex		0.04	1.48	<.01
Age Group		-0.06	-1.89	<.01
CES-D		0.30	10.10***	.09
Step 3	.10***			
Sex		0.03	1.06	<.01
Age Group		<0.01	-0.05	<.01
CES-D		0.26	9.36***	.07
Reflective		0.13	3.18**	.01
Ruminative		0.30	8.13***	.05
Generative		-0.01	-0.24	<.01
Social		-0.15	-3.87***	.01
Step 4	<.01			
Sex		0.04	1.24	<.01
Age Group		<0.01	0.09	<.01
CES-D		0.27	9.46***	.07
Reflective		0.14	3.31***	.01
Ruminative		0.30	8.06***	.05
Generative		-0.03	-0.71	<.01
Social		-0.14	-3.67***	.01
Age x Reflective		0.07	1.77	<.01
Age x Ruminative		-0.03	-0.80	<.01
Age x Generative		-0.05	-1.30	<.01
Age x Social		0.04	1.14	<.01
Full model, <i>R</i> ²	.20***			

Note. CES-D = Center for Epidemiologic Studies – Depression Scale.

PCL-C = Posttraumatic Stress Disorder Checklist-Civilian.

* $p < .05$. ** $p < .01$. *** $p \leq .001$

Footnotes

¹ We conducted a regression analysis employing age as a continuous variable. The results were largely the same as those presented in Table 3 with the ruminative ($\beta = .31, p < .001$) and reflective ($\beta = .14, p = .001$) functions predicting higher PTSS, whereas the social ($\beta = -.14, p < .001$) function was related to lower PTSS. The age x function interactions were non-significant ($ps > .07$).