Social Behavior and Personality
an international journal

Social Behavior and Personality, Volume 50, Issue 2, e10915
https://doi.org/10.2224/sbp.10915
www.sbp-journal.com

Emotional autobiographical memory impairment features in three mental disorders

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How to cite: Yang, Z., & Liu, X. (2022). Emotional autobiographical memory impairment features in three mental disorders. *Social Behavior and Personality: An international journal, 50*(2), e10915

We proposed the Emotional Autobiographical Memory Test (EAMT) as a specialized method for measuring emotional autobiographical memory impairment in patients with mental disorders. The EAMT was tested with 32 patients with schizophrenia, 18 patients with bipolar disorder, 32 patients with depression, and 42 people undiagnosed with such disorders. We extracted 13 indices of five kinds of features from participants' emotional autobiographical memory and compared them among the four groups. The overgeneralization result in the schizophrenia and depression groups was consistent with previous results, supporting the EAMT's validity. However, inconsistent with previous results, overgeneralization was not found in the bipolar disorder group. Further, the count of involuntary memories in the patient groups (vs. control group) was significantly smaller, which can guide future researchers in investigating the psychopathology of mental disorders.

Keywords
emotional autobiographical memory; emotions; overgeneralization; schizophrenia; depression; bipolar disorder; mental health disorders; scale development

Article Highlights

- We developed the Emotional Autobiographical Memory Test to measure emotional autobiographical memory impairment in patients with mental disorders.
- Overgeneralization of autobiographical memory was found in the groups with schizophrenia and depression, but not in the group with bipolar disorder.
- The involuntary memories count in the three groups (schizophrenia, depression, bipolar disorder) was significantly smaller than in the control group.

Autobiographical memory (AM) is the aspect of memory concerned with the recollection of personally experienced past events. AM has a multilayered structure, comprising lifetime periods, general events, and event-specific knowledge from top to bottom (Fivush et al., 2011; Rybak-Korneluk et al., 2016). From another perspective, AM comprises distinct multimodal components: sensory, perceptual, spatiotemporal, emotional, and semantic (Conway & Pleydell-Pearce, 2000). We defined *emotional autobiographical memory* (EAM) as a form of AM that includes emotional information.

Many previous studies have found that AM impairment plays an important role in the psychopathology of emotional disorders (Docteur et al., 2020; Fang & Dong, 2021; Hallford et al., 2021; Moscovitch et al., 2018;

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Ono et al., 2016; Williams et al., 2007). *Overgeneralization* is a psychopathological feature of AM disorders, illustrating that the proportion of specific memory in AM recalled on the completion of the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986) is significantly lower than that in the general population, whereas the proportion of generic memory is significantly higher than that in the general population. In the AMT, a retrieved AM that occurred at a specific time and place and lasted less than 1 day is referred to as a *specific AM*, whereas a retrieved AM that does not meet the standard of a specific AM is considered a *generic AM* (Barry et al., 2021; Liu et al., 2010; Williams et al., 2007).

Intrusive memory is an obvious marker of several emotional disorders, such as flashback disorders in posttraumatic stress disorder and flash-forward disorders in depression (Berntsen & Nielsen, 2021; Ford, 2018; Holmes & Mathews, 2010; Yeung & Fernandes, 2020). The most typical features of intrusive memory are its uncontrolled retrieval mode and severe negative emotions (Lau-Zhu et al., 2018; Marks et al., 2018). Intrusive memory is the manifestation of involuntary AM in the psychopathological stage. *Involuntary AM* is defined as a memory phenomenon where people retrieve personal experiences without a purpose, plan, or will, whereas in *voluntary AM*, people purposefully and willingly retrieve personal experiences (Berntsen, 1996).

In addition, the response features (e.g., recall delay), temporal features (e.g., time forgetting), and emotional features (e.g., negative emotion bias) of AM may be related to the psychopathology of mental disorders (Jack & Hayne, 2007; Kihlstrom & Harackiewicz, 1982; Peterson & Nguyen, 2010; Wang et al., 1998; Yao et al., 2010). However, previous investigations of AM features in mental health disorders have shown inconsistent results because there is no standardized tool for AM assessment (Liu et al., 2010; Zhang & Xu, 2011).

The AMT (Williams & Broadbent, 1986) is one of the earliest tools used in AM studies, and it presents five positive and five negative emotional cue words to aid AM recollection. These AM cues are encoded into specific, generic, extended, or other types to establish respondents' recollection style, based on the scores for each type of memory. The psychopathological features of AM overgeneralization have been found in patients with various mental disorders through the use of the AMT (Williams & Broadbent, 1986; Williams et al., 2007).

However, the AMT has shortcomings, of which one of the most significant is the set of cue words, which are the stimuli that trigger the recall of past events. The number and features of cue words are key factors affecting individual responses (Zhang & Xu, 2011). The AMT classifies emotional cue words into positive and negative categories, but the valence of some emotional cues may vary under specific conditions. Some cue words are too complicated for patients with mental disorders to recollect specific past events, for example, it is difficult for a patient with schizophrenia to recollect a "lonely" or "safe" episode. In addition, a meta-analysis (Liu et al., 2010) showed that approximately 15 cue words are appropriate for AM tests. The number of cue words in the AMT is small, the effect value of specific AMs is small, thus reducing the sensitivity of the test (Liu et al., 2010). Another obvious defect is that the AMT evaluates only the specific and generic features of memory and does not involve aspects related to psychopathology, such as retrieval mode or temporal features.

This study sought to establish a new method to test AM by improving the AMT in two ways: First, the six basic emotions identified by Ekman (1999), comprising happiness, surprise, fear, anger, sadness, and disgust, were used as cue words, and were recalled three times each. Keltner et al. (2019) stated that each basic emotion has independent experiences and is associated with adaptive functions, and nonbasic emotions or complex emotions are mixtures of multiple basic emotions. The use of basic emotions as cue words may be more easily understood, more easily linked to AM, and more comprehensive, which is conducive to improving the sensitivity of the test. Second, we aimed to increase the evaluation content. In addition to specific and generic encoding, we comprehensively evaluated four aspects of AM: retrieval mode,

response feature, temporal feature, and emotion feature.

Therefore, we proposed the Emotional Autobiographical Mental Test (EAMT), which we tested with a patient sample with mental health disorders comprising schizophrenia, depression, and bipolar disorder, along with a control group to verify its reliability and validity. We also extracted and compared the phenomenological features of EAM for further research into the psychopathology of mental health disorders.

Method

Participants

We recruited three patient groups from two psychiatric hospital wards via posters that contained full details of our experiment, covering its purpose, methodology, and location, along with ethical approval information, privacy protection, and inclusion and exclusion criteria. The inclusion criterion was diagnosis by psychiatrists using the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; American Psychiatric Association, 2013) with one of three mental disorders: schizophrenia, depression, or bipolar disorder. The participants were aged between 16 and 36 years, educated at a junior high school level or above, and could read Chinese. Exclusion criteria were other mental comorbidities or inability to complete the recollection task. Each participant made an appointment with the doctor in charge and after the doctor's agreement, a nurse brought the participant to the ward laboratory to participate in the experiment. Participants were paid RMB 200 (USD 31.00).

We recruited the control group from the general population using similar posters positioned in public places, such as schools and hospitals, near the experimental site. These participants made an appointment by telephone and went to the experiment preparation room at the appointed time. They were introduced to the experiment by the researchers, after which they completed the experiment and were paid RMB 200 (USD 31.00). Individuals were included in this group if they were aged between 16 and 36 years, educated at a junior high school level or above, could easily read Chinese, and had not been diagnosed with a psychiatric disorder.

We recruited 124 participants, comprising 32 with schizophrenia, 18 with bipolar disorder, 32 with depression, and 42 control individuals. All of them were provided with a complete description of the study and gave written informed consent before participation. The experimental procedures were approved by the Ethics Committee of the First Affiliated Hospital of the Air Force Medical University, China, and adhered to the principles of the Declaration of Helsinki.

Procedure and Measures

Test Preparation

The Positive and Negative Syndrome Scale (Kay et al., 1987), the Hamilton Depression Scale (Hamilton, 1967), and the Bech-Rafaelsen Mania Rating Scale (Licht & Jensen, 1997) were administered by psychiatrists to assess participants' severity of symptoms. The researcher explained the experiment to the participants with detailed instructions.

Test Implementation

The operation instruction for each basic emotion was presented to participants through a slide, and they recalled and reported a specific event with the deepest experience of a basic emotion within 60 seconds. An oral prompt to be more specific was given if the first response was insufficiently detailed.

For each reported AM, participants noted when and where the event occurred and who was involved, and then used a 7-point Likert scale to rate the vividness of the memory (cue: "If the memory contains a sensory

experience, e.g., a picture or voice, please rate the vividness of the sensory experience on a scale of 1–7, where 1 point means the feeling is vague or unclear, and 7 points means it is as if you are actually seeing or hearing the event"; Pearson et al., 2013). Next, respondents used a 7-point Likert scale to rate how they felt (cue: "Rating how you felt at the time of the event, 1 point means just a little bit of that feeling, and 7 points means that the feeling was as intense as you have ever experienced it"), and they then used the 7-point Likert scale to rate the extent of the feeling now (cue: "How do you feel when you recall the event now? The grading is the same as the last question"). Finally, they noted if they thought of the event involuntarily during ordinary times. These questions were presented on another slide and answered one by one. The cues were spoken to the participants by the researcher.

Participants recalled the three most impressive things about each basic emotion. To preclude participants developing an attitude of avoidance and distrust, the basic emotions were assigned in the sequence of happiness, surprise, disgust, anger, fear, and sadness, ranging from positive to neutral to negative. The responses were audio recorded and subsequently transcribed by the researcher.

Character Encoding

If a memory retrieved within 60 seconds did not meet the requirement for a specific EAM, or the reporting time exceeded 60 seconds, it was encoded as a generic EAM. If the participant reported thinking of a memory involuntarily at an ordinary time, this memory was encoded as an involuntary EAM, and the remaining memories were encoded as voluntary EAMs (Mowlds et al., 2010; Peeters et al., 2002).

A random sample of one-third of the participants was independently rated by a trained rater to assess the interrater reliability. Cohen's kappa ranged from .86 to .93, indicating acceptable to good agreement levels.

Data Analysis

We used Excel 2007 to record and encode the original data, and then analyzed the data using SPSS 19.0. Five feature indices were extracted for each participant:

1. Response features were evaluated by a memory count, which refers to the total count of reported memories.
2. Emotional features comprised four indices: mean of original emotional intensity, mean of present emotional intensity, sustaining emotions count, and mean of degree of emotional weakening. Original emotions were those felt when the events occurred and present emotions were those experienced while the participant reported the events during the test. When the present (vs. original) emotions were the same, they were classified as a sustaining emotion, and when a present emotion was a sustaining emotion or did not exist, the degree of emotional weakening was calculated as the original emotional intensity minus the present emotional intensity. The participant's four indices could then be calculated on the basis of the emotional intensity scores of all their reported EAMs.
3. Temporal features comprised four indices: minimum age of occurrence, maximum age of occurrence, average age of occurrence, and time span of memory. On the basis of the age of occurrence of all EAM events reported by a participant, the minimum value, maximum value, and average value could be calculated. The time span of a memory referred to the amount of time from the occurrence of the event to the test, and the average time span of memory was the average length of the time span of all reported EAMs by a participant.
4. Overgeneralization comprised two indices for each participant: specific events count and generic events count.
5. Retrieval approach comprised two indices for each participant: voluntary AM count and involuntary AM count.

We compared each index among the four groups. First, we conducted single-factor analyses to determine if each demographic and cognitive factor significantly influenced the target index. We then performed multiple-factor analyses: If no demographic or cognitive factors significantly affected the target index, a one-

way analysis of variance was used to compare the index among the four groups; if certain demographic or cognitive factors significantly influenced the target index, an analysis of covariance was performed; and if two or more demographic and cognitive factors significantly influenced the target index, a multiple regression analysis was performed, which involved the setting of dummy variables to conduct post hoc pairwise comparisons. We used these statistical methods to eliminate the interference of demographic and cognitive factors. The significance level was set at $p < .05$ (two-tailed).

Results

Participants' demographic and clinical data are shown in Table 1. Comparisons of the phenomenological features of the EAMT results are shown in Table 2.

Table 1. *Participants' Demographic and Clinical Characteristics*

Characteristic	Schizophrenia group ($n = 32$)	Bipolar disorder group ($n = 18$)	Depression group ($n = 32$)	Control group ($n = 42$)
Men: *n* (%)	29.0 (90.6)	18.0 (100.0)	23.0 (71.9)	23.0 (54.8)
Women: *n* (%)	3.0 (9.4)	9.0 (28.1)	19.0 (45.2)	
Age: years	26.5 (4.6)	22.5 (3.8)	22.9 (6.7)	22.1 (4.0)
Level of education: years	12.9 (2.8)	13.2 (1.5)	13.6 (2.7)	13.8 (1.4)
Marital status: *n* (%)				
Single	27.0 (84.3)	16.0 (88.8)	26.0 (81.2)	37.0 (88.1)
Married	5.0 (15.7)	2.0 (11.2)	6.0 (18.8)	5.0 (11.9)
PANSS scores	46.4 (10.4)			
Positive dimension	10.8 (3.5)			
Negative dimension	12.1 (3.9)			
General psychopathology dimension	23.5 (5.4)			
BRMS scores		6.4 (3.6)		
HAMD scores			17.91 (9.5)	

Note. Values are reported as *M* (*SD*) unless otherwise noted. PANSS = Positive and Negative Syndrome Scale; BRMS = Bech-Rafaelsen Mania Rating Scale; HAMD = Hamilton Depression Scale.

Response Feature

A multiple linear regression analysis of memory counts shows that the regression equation was significant, Adj. $R^2(3, 116) = .12$, $p < .001$. Regression parameter comparison results show that memory count of the control group ($M = 16.31$, $SD = 3.12$) was significantly higher than that of the group with depression ($M = 12.38$, $SD = 4.72$), $t(116) = 2.78$, $p = .006$.

Emotional Feature

The sustaining emotions count was analyzed by multiple linear regression, indicating that the regression equation was significant, Adj. $R^2(3, 119) = .18$, $p < .001$. The sustaining emotions count in the control group ($M = 12.33$, $SD = 3.94$) was significantly greater than that in the group with bipolar disorder ($M = 7.89$, $SD = 3.91$), $t(119) = 2.39$, $p = .018$, and the group with depression ($M = 8.16$, $SD = 4.40$), $t(119) = 2.95$, $p = .004$.

Temporal Feature

Multiple linear regression analysis of maximum age of occurrence showed that the regression equation was significant, Adj. $R^2(3, 119) = .82$, $p < .001$. The maximum age of occurrence in the control group ($M = 21.88$, $SD = 3.75$) was significantly higher than that in the group with depression ($M = 21.34$, $SD = 6.91$), $t(119) =$

2.37, $p = .019$.

Multiple linear regression analysis of average age of occurrence showed that the regression equation was significant, Adj. $R^2(3, 118) = .55$, $p < .001$. The average age of occurrence in the control group ($M = 18.51$, $SD = 3.03$) was significantly higher than that in the group with depression ($M = 17.62$, $SD = 6.18$), $t(118) = 2.17$, $p = .032$.

Overgeneralization Feature

The specific events count was analyzed by multiple linear regression, indicating that the regression equation was significant, Adj. $R^2(3, 119) = .24$, $p < .001$. The specific events count in the control group ($M = 12.50$, $SD = 3.35$) was significantly greater than that in the group with schizophrenia ($M = 7.81$, $SD = 3.87$), $t(119) = 2.15$, $p = .034$, and the group with depression ($M = 8.69$, $SD = 4.41$), $t(119) = 3.06$, $p = .003$.

Retrieval Approach

Analysis of the involuntary memories count also involved multiple linear regression, and the equation was significant, Adj. $R^2(3, 119) = .22$, $p < .001$. The control group ($M = 10.76$, $SD = 3.77$) reported significantly more involuntary memories than the group with schizophrenia ($M = 6.69$, $SD = 5.87$), $t(119) = 2.26$, $p = .026$, the group with bipolar disorder ($M = 5.33$, $SD = 3.03$), $t(119) = 3.70$, $p < .001$, and the group with depression ($M = 5.78$, $SD = 3.34$), $t(119) = 4.24$, $p < .001$.

A covariance test was used for comparison of the voluntary memories count. Results show that the voluntary memories count was significantly different among the four groups, $F(3, 116) = 3.76$, $p = .013$. Pairwise comparisons show that the group with bipolar disorder ($M = 7.28$, $SD = 3.69$) reported significantly more voluntary memories than the group with schizophrenia ($M = 4.81$, $SD = 4.08$, $p = .029$).

Correlations of Each Feature

We selected indices with significant differences among the groups to calculate the correlation coefficients, which allowed us to explore the internal mechanisms (see Table 3). Of the indices, the positive correlations between the counts of specific events, sustaining emotions, and involuntary events were suggestive for psychopathology. That is, the specific events count was positively correlated with the sustaining emotions count, $r(122) = .66$, $p < .001$, the specific events count was positively correlated with the involuntary events count, $r(122) = .55$, $p < .001$, and the sustaining emotions count was positively correlated with the involuntary events count, $r(122) = .74$, $p < .001$.

Table 2. *Comparison of Participants' Emotional Autobiographical Memory Features Among the Four Groups*

Indices	*M* (*SD*)					Statistical analysis method	Result	Post hoc pairwise comparison
	Schizophrenia (n = 32)	Bipolar disorder (n = 18)	Depression (n = 32)	Control (n = 42)	Total			
Response feature								
1. Memory count	11.50 (5.25)	12.61 (3.96)	12.38 (4.72)	16.31 (3.12)	13.52 (4.71)	Multiple regression	Adj. R^2 (3, 116) = .25, p = .056	Depression < Control, t(116) = 2.78, p = .006
Emotional feature								
2. Mean of original emotional intensity	5.71 (1.11)	5.92 (0.75)	6.08 (0.64)	6.20 (0.59)	6.00 (0.80)	Covariance	F(3, 119) = 0.72, p = .544	
3. Mean of present emotional intensity	4.71 (1.15)	5.21 (0.94)	5.06 (1.23)	5.30 (0.94)	5.08 (1.09)	Covariance	F(3, 115) = 2.04, p = .112	
4. Sustaining emotions count	8.25 (5.41)	7.89 (3.91)	8.1 (4.40)	12.33 (3.94)	9.56 (4.85)	Multiple regression	Adj. R^2 (3, 119) = .18, p = .018	Bipolar disorder < Control, t(119) = –2.39, p = .018 Depression < Control, t(119) = –2.95, p = .004
5. Mean of degree of emotional weakening	2.38 (1.48)	2.50 (1.48)	2.38 (1.26)	2.05 (1.07)	2.28 (1.29)	One-way variance	F(3, 120) = 0.75, p = .527	
Temporal feature								
6. Minimum age of occurrence	9.88 (4.02)	9.11 (4.75)	11.13 (5.97)	10.71 (4.67)	10.37 (4.89)	Covariance	F(3, 116) = 1.14, p = .338	
7. Maximum age of occurrence	25.28 (4.63)	22.17 (3.84)	21.34 (6.91)	21.88 (3.75)	22.66 (5.16)	Multiple regression	Adj. R^2 (3, 119) = .82, p = .100	Depression < Control, t(119) = 2.40, p = .018
8. Average age of occurrence	19.06 (4.52)	17.44 (3.52)	17.62 (6.18)	18.51 (3.03)	18.27 (4.47)	Multiple regression	Adj. R^2 (3, 118) = .55, p = .060	Schizophrenia < Control, t(118) = –2.37, p = .019 Depression < Control, t(118) = –2.17, p = .032
9. Time span of memory	89.78 (47.64)	64.06 (24.19)	63.79 (45.17)	45.83 (36.47)	64.45 (43.54)	Multiple regression	Adj. R^2 (3, 117) = .36, p = .651	
Overgeneralization feature								
10. Specific events count	7.81 (3.87)	10.22 (3.54)	8.69 (4.41)	12.50 (3.35)	9.98 (4.24)	Multiple regression	Adj. R^2 (3, 119) = .24, p = .019	Schizophrenia < Control, t(119) = –2.15, p = .034 Depression < Control, t(119) = –3.06, p = .003
11. Generic events count	3.69 (3.69)	2.39 (2.17)	3.66 (2.61)	3.81 (2.66)	3.53 (2.90)	One-way analysis of variance	F(3, 120) = 1.12, p = .346	
Retrieval approach								
12. Voluntary memories count	4.81 (4.08)	7.28 (3.69)	6.59 (4.23)	5.55 (3.78)	5.88 (4.02)	Covariance	F(3, 116) = 3.76, p = .013	Schizophrenia < Bipolar disorder, MD = –2.72, p = .029
13. Involuntary memories count	6.69 (5.87)	5.33 (3.03)	5.78 (3.34)	10.76 (3.77)	7.64 (4.77)	Multiple regression	Adj. R^2 (3, 119) = .22, p < .001	Schizophrenia < Control, t(119) = −2.26, p = .026 Bipolar disorder < Control, t(119) = 3.70, p < .001 Depression < Control, t(119) = 4.24, p < .001

Note. *MD* = mean difference. The meaning of the table indices is shown in the character encoding and data analysis section of the text.

Table 3. *Correlation Coefficients of the Indices With Significant Differences Among the Groups*

Indices	1	2	3	4	5
1. Memory count	1				
2. Sustaining emotions count	.800***	1			
3. Average age of occurrence	.004	.084	1		
4. Specific events count	.794***	.663***	–.004	1	
5. Involuntary memories count	.641***	.736***	.155	.551***	1

Note. *** p < .001.

Discussion

A comparison of the response features among the four groups of participants showed that the memory count in the group with depression (vs. control group) was significantly smaller, and no significant difference was found among the groups with schizophrenia or bipolar disorder. This result suggests that individuals with depression may have delayed recall in AM function. This result is similar to those of Kaviani et al. (2005) and Yao et al. (2010). However, Kaviani et al. used the reaction time index to evaluate response features, whereas we used the total number of reported memories to evaluate response features.

A comparison of the emotional features among the four groups showed that the sustaining emotions count in the control group was significantly higher than that in the groups with bipolar disorder and depression. These results suggest that bipolar disorder and depressive disorder may increase the tendency toward AM emotion evaluation transformation. Bipolar and depressive disorders belong to the category of mood disorders, and abnormal functions in mood are among the most typical features of people diagnosed with such disorders. When patients are in an abnormal mood, EAM cognition and experience may be affected (King et al., 2010), which may explain AM emotion evaluation transformation.

A comparison of the temporal features among the four groups showed that the maximum age of occurrence in the group with depression (vs. control group) was significantly lower, and the average age of occurrence in the group with depression (vs. control group) was significantly lower. These results show that the average age of occurrence of life events with the strongest psychological experience in patients with depression was significantly lower than that in the control population, which suggests a correlation between childhood trauma caused by adverse life events and depression (Famularo et al., 1992; He et al., 2019; Heim et al., 2008).

Regarding overgeneralization, the results show significant overgeneralization in the groups with schizophrenia and depression, which is consistent with previous results (Peeters et al., 2002; van Vreeswijk & de Wilde, 2004; Williams et al., 2007), supporting the validity of the EAMT. However, there was no significant overgeneralization in the group with bipolar disorder, which is inconsistent with previous results (Boulanger et al., 2013; Docteur et al., 2020; Mowlds et al., 2010; Sun et al., 2012). One reason may be that our participants were remitted patients with bipolar disorder whose depressed mood was not obvious.

Involuntary AMs are unintended recollections of personal experiences (Berntsen & Hall, 2004), but when they follow a previous conscious attempt to recall the memory, they can also be retrieved (Chen & Li, 2014). Therefore, although all AMs in the EAMT were retrieved intentionally, those AMs that are always recollected unintentionally in daily life can be regarded as involuntary. We found that the involuntary memories count in the three mental health disorder groups (vs. control group) was significantly lower, implying that involuntary AMs may perform an important psychological defense function (Allé et al., 2019, 2020; Chen & Li, 2014). The detailed contents of involuntary AMs, especially intrusive AMs, very likely include traumatic experiences not effectively processed and integrated, which may be the main etiology of mental disorders (Chen & Li, 2014).

There are several limitations in this study. First, the sample size was relatively small, and the lack of female participants led to a sex ratio imbalance. Second, the privacy of AM means that participants may not have reported some extracted memories. Third, because emotional state influences the retrieval of AM (Schaefer & Philippot, 2005) and recollected EAM can elicit emotion, one retrieval task could interfere with a subsequent retrieval task. As we used only one cue card to recall the three autobiographical memories, the mutual interference between the recall tasks may have been small, in comparison with the use of different cue words.

In conclusion, we proposed the EAMT as an alternative tool that can be used to comprehensively assess the features of AM. Our finding of no significant overgeneralization in the group with bipolar disorder is inconsistent with previous results. This contrast and our other novel results, such as the significantly

smaller count of involuntary memories in the mental health disorder groups (vs. control group), provide clues to guide future researchers investigating the psychopathology of mental disorders.

References

Allé, M. C., Berna, F., & Berntsen, D. (2019). Individuals with psychotic-like experiences exhibit enhanced involuntary autobiographical memories. *Psychiatry Research, 273,* 281–287. https://doi.org/10.1016/j.psychres.2019.01.050

Allé, M. C., Berna, F., Danion, J.-M., & Berntsen, D. (2020). Seeing or hearing one's memories: Manipulating autobiographical memory imagery in schizophrenia. *Psychiatry Research, 286,* Article e112835. https://doi.org/10.1016/j.psychres.2020.112835

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Barry, T. J., Gregory, J. D., Latorre, J. M., Ros, L., Nieto, M., & Ricarte, J. J. (2021). A multi-method comparison of autobiographical memory impairments amongst younger and older adults. *Aging & Mental Health, 25*(5), 856–863. https://doi.org/10.1080/13607863.2020.1729338

Berntsen, D. (1996). Involuntary autobiographical memories. *Applied Cognitive Psychology, 10*(5), 435–454. https://doi.org/10.1002/acp.1776

Berntsen, D., & Hall, N. M. (2004). The episodic nature of involuntary autobiographical memories. *Memory & Cognition, 32*(5), 789–803. https://doi.org/10.3758/BF03195869

Berntsen, D., & Nielsen, N. P. (2021). The reconstructive nature of involuntary autobiographical memories. *Memory*. Advance online publication. https://doi.org/10.1080/09658211.2021.1872645

Boulanger, M., Lejeune, A., & Blairy, S. (2013). Overgenerality memory style for past and future events and emotions related in bipolar disorder. What are the links with problem solving and interpersonal relationships? *Psychiatry Research, 210*(3), 863–870. https://doi.org/10.1016/j.psychres.2013.06.029

Chen, G., & Li, L. (2014). The review of involuntary autobiographical memories [In Chinese]. *Journal of Psychological Science, 37*(1), 245–252. https://bit.ly/3Db8fR4

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review, 107*(2), 261–288. https://doi.org/10.1037/0033-295X.107.2.261

Docteur, A., Mirabel-Sarron, C., Kaya Lefèvre, H., Sala, L., Husky, M., Swendsen, J., & Gorwood, P. (2020). Role of autobiographical memory in the impact of MBCT on dysfunctional attitudes, depressive symptoms and anxiety in bipolar I patients. *Journal of Affective Disorders, 276,* 907–913. https://doi.org/10.1016/j.jad.2020.07.072

Ekman, P. (1999). Basic emotions. In T. Dalgleish & M. J. Power (Eds.), *Handbook of cognition and emotion* (pp. 45–60). Wiley. https://doi.org/10.1002/0470013494.ch3

Famularo, R., Kinscherff, R., & Fenton, T. (1992). Psychiatric diagnoses of maltreated children: Preliminary findings. *Journal of the American Academy of Child & Adolescent Psychiatry, 31*(5), 863–867. https://doi.org/10.1097/00004583-199209000-00013

Fang, J., & Dong, Y. (2021). Autobiographical memory disturbance in depression. *Psychology, Health & Medicine*. Advance online publication.
https://doi.org/10.1080/13548506.2021.1916954

Fivush, R., Habermas, T., Waters, T. E. A., & Zaman, W. (2011). The making of autobiographical memory: Intersections of culture, narratives and identity. *International Journal of Psychology, 46*(5), 321–345.
https://doi.org/10.1080/00207594.2011.596541

Ford, J. D. (2018). Trauma memory processing in posttraumatic stress disorder psychotherapy: A unifying framework. *Journal of Traumatic Stress, 31*(6), 933–942.
https://doi.org/10.1002/jts.22344

Hallford, D. J., Rusanov, D., Yeow, J. J. E., & Barry, T. J. (2021). Overgeneral and specific autobiographical memory predict the course of depression: An updated meta-analysis. *Psychological Medicine, 51*(6), 909–926.
https://doi.org/10.1017/S0033291721001343

Hamilton, M. (1967). Development of a rating scale for primary depressive illness. *British Journal of Social and Clinical Psychology, 6*(4), 278–296.
https://doi.org/10.1111/j.2044-8260.1967.tb00530.x

He, J., Zhong, X., Gao, Y., Xiong, G., & Yao, S. (2019). Psychometric properties of the Chinese version of the Childhood Trauma Questionnaire-Short Form (CTQ-SF) among undergraduates and depressive patients. *Child Abuse & Neglect, 91,* 102–108.
https://doi.org/10.1016/j.chiabu.2019.03.009

Heim, C., Newport, D. J., Mletzko, T., Miller, A. H., & Nemeroff, C. B. (2008). The link between childhood trauma and depression: Insights from HPA axis studies in humans. *Psychoneuroendocrinology, 33*(6), 693–710.
https://doi.org/10.1016/j.psyneuen.2008.03.008

Holmes, E. A., & Mathews, A. (2010). Mental imagery in emotion and emotional disorders. *Clinical Psychology Review, 30*(3), 349–362.
https://doi.org/10.1016/j.cpr.2010.01.001

Jack, F., & Hayne, H. (2007). Eliciting adults' earliest memories: Does it matter how we ask the question? *Memory, 15*(6), 647–663.
https://doi.org/10.1080/09658210701467087

Kaviani, H., Rahimi-Darabad, P., & Naghavi, H. R. (2005). Autobiographical memory retrieval and problem-solving deficits of Iranian depressed patients attempting suicide. *Journal of Psychopathology and Behavioral Assessment, 27*(1), 39–44.
https://doi.org/10.1007/s10862-005-3264-0

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin, 13*(2), 261–276.
https://doi.org/10.1093/schbul/13.2.261

Keltner, D., Sauter, D., Tracy, J., & Cowen, A. (2019). Emotional expression: Advances in basic emotion theory. *Journal of Nonverbal Behavior, 43*(2), 133–160.
https://doi.org/10.1007/s10919-019-00293-3

Kihlstrom, J. F., & Harackiewicz, J. M. (1982). The earliest recollection: A new survey. *Journal of Personality, 50*(2), 134–148.
https://doi.org/10.1111/j.1467-6494.1982.tb01019.x

King, M. J., MacDougall, A. G., Ferris, S. M., Levine, B., MacQueen, G. M., & McKinnon, M. C. (2010). A review of factors that moderate autobiographical memory performance in patients with major depressive disorder. *Journal of Clinical and Experimental Neuropsychology, 32*(10), 1122–1144.
https://doi.org/10.1080/13803391003781874

Lau-Zhu, A., Holmes, E. A., & Porcheret, K. (2018). Intrusive memories of trauma in the laboratory: Methodological developments and future directions. *Current Behavioral Neuroscience Reports, 5*(1), 61–71. https://doi.org/10.1007/s40473-018-0141-1

Licht, R. W., & Jensen, J. (1997). Validation of the Bech-Rafaelsen Mania Scale using latent structure analysis. *Acta Psychiatrica Scandinavica, 96*(5), 367–372. https://doi.org/10.1111/j.1600-0447.1997.tb09931.x

Liu, X., Yao, S., Xiao, J., & Yang, J. (2010). The autobiographical memory characteristics of patients with depressive disorder and the appliance of the Autobiographical Memory Test: A meta-analysis [In Chinese]. *Advances in Psychological Science, 18*(4), 578–589.

Marks, E. H., Franklin, A. R., & Zoellner, L. A. (2018). Can't get it out of my mind: A systematic review of predictors of intrusive memories of distressing events. *Psychological Bulletin, 144*(6), 584–640. https://doi.org/10.1037/bul0000132

Moscovitch, D. A., Vidovic, V., Lenton-Brym, A. P., Dupasquier, J. R., Barber, K. C., Hudd, T., Zabara, N., & Romano, M. (2018). Autobiographical memory retrieval and appraisal in social anxiety disorder. *Behaviour Research and Therapy, 107,* 106–116. https://doi.org/10.1016/j.brat.2018.06.008

Mowlds, W., Shannon, C., McCusker, C. G., Meenagh, C., Robinson, D., Wilson, A., & Mulholland, C. (2010). Autobiographical memory specificity, depression, and trauma in bipolar disorder. *British Journal of Clinical Psychology, 49*(2), 217–233.

Ono, M., Devilly, G. J., & Shum, D. H. K. (2016). A meta-analytic review of overgeneral memory: The role of trauma history, mood, and the presence of posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy, 8*(2), 157–164. https://doi.org/10.1037/tra0000027

Pearson, D. G., Deeprose, C., Wallace-Hadrill, S. M. A., Heyes, S. B., & Holmes, E. A. (2013). Assessing mental imagery in clinical psychology: A review of imagery measures and a guiding framework. *Clinical Psychology Review, 33*(1), 1–23. https://doi.org/10.1016/j.cpr.2012.09.001

Peeters, F., Wessel, I., Merckelbach, H., & Boon-Vermeeren, M. (2002). Autobiographical memory specificity and the course of major depressive disorder. *Comprehensive Psychiatry, 43*(5), 344–350. https://doi.org/10.1053/comp.2002.34635

Peterson, C., & Nguyen, D. T. K. (2010). Parent–child relationship quality and infantile amnesia in adults. *British Journal of Psychology, 101*(4), 719–737. https://doi.org/10.1348/000712609X482948

Rybak-Korneluk, A., Wichowicz, H. M., Żuk, K., & Dziurkowski, M. (2016). Autobiographical memory and its meaning in selected mental disorders [In Polish]. *Psychiatria Polska, 50*(5), 959–972. https://doi.org/10.12740/PP/38518

Schaefer, A., & Philippot, P. (2005). Selective effects of emotion on the phenomenal characteristics of autobiographical memories. *Memory, 13*(2), 148–160. https://doi.org/10.1080/09658210344000648

Sun, J. Y., Ha, R. Y., Lee, S. J., Ryu, V., Ha, K., & Cho, H.-S. (2012). Autobiographical memory in patients with bipolar disorder [In Korean]. *Korean Journal of Biological Psychiatry, 19*(1), 63–69. https://bit.ly/3CcIXAJ

van Vreeswijk, M. F., & de Wilde, E. J. (2004). Autobiographical memory specificity, psychopathology, depressed mood and the use of the Autobiographical Memory Test: A meta-analysis. *Behaviour Research and Therapy, 42*(6), 731–743. https://doi.org/10.1016/S0005-7967(03)00194-3

Wang, Q., Leichtman, M. D., & White, S. H. (1998). Childhood memory and self-description in young Chinese adults: The impact of growing up an only child. *Cognition, 69*(1), 73–103. https://doi.org/10.1016/S0010-0277(98)00061-4

Williams, J. M., & Broadbent, K. (1986). Autobiographical memory in suicide attempters. *Journal of Abnormal Psychology, 95*(2), 144–149. https://doi.org/10.1037/0021-843X.95.2.144

Williams, J. M., Barnhofer, T., Crane, C., Hermans, D., Raes, F., Watkins, E., & Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder. *Psychological Bulletin, 133*(1), 122–148. https://doi.org/10.1037/0033-2909.133.1.122

Yao, S., Liu, X., Zhao, W., Yang, W., & Tan, F. (2010). Autobiographical memory of depressed patients [In Chinese]. *Journal of Central South University (Medical Sciences), 35*(7), 679–684. https://doi.org/10.3969/j.issn.1672-7347.2010.07.006

Yeung, R. C., & Fernandes, M. A. (2020). Recurrent involuntary autobiographical memories: Characteristics and links to mental health status. *Memory, 28*(6), 753–765. https://doi.org/10.1080/09658211.2020.1777312

Zhang, H. Y., & Xu, Y. (2011). The standard assessment of cue words in the Autobiographical Memory Test (AMT) [In Chinese]. *Psychological Exploration, 31*(6), 503–507.